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ROYAL SOCIETY.

REPORTS

OF THE

SLEEPING SICKNESS COMMISSION.

No. III.

6. The Epidemiology and Etiology of Sleeping Sickness in Equatorial East Africa, with Clinical Observations. By CUTHBERT CHRISTY, B.M., C.M. (Edin.).
7. Report on a Collection of Mosquitoes and other Flies from Equatorial East Africa and the Nile Provinces of Uganda. By FRED. V. THEOBALD, M.A., etc.

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6.

THE EPIDEMIOLOGY AND ETIOLOGY OF SLEEPING SICKNESS IN EQUATORIAL EAST AFRICA, WITH CLINICAL OBSERVATIONS.

By CUTHBERT CHRISTY, B.M., C.M. (Edin.).

(Written July 14, 1903,—Received (with revisions), Sept. 5, 1903.)

(With 4 plates and 5 maps.)

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1. Early Records of Sleeping Sickness.

The first descriptive account of the disease would appear to be the outcome of the observations of Dr. T. Winterbottom, who, in 1803, records the following* :—

> "The Africans are very subject to a species of lethargy, which they are much afraid of, as it proves fatal in every instance. The Timmanees call it márree, or 'nluoi, and the Bulloms nagónlôe, or kadura; it is called by the Soosoos, Kee Kóllee Kondee, or sleepy sickness, and by the Mandingoes seenoyuncaree, a word of similar import. This disease is very frequent in the Foo-la country, and it is said to be much more common in the interior parts of the country than upon the sea coast. Children are very rarely, or never, affected by this complaint, nor is it more common among slaves than among free people, though it is asserted that the slaves from Bennin are very subject to it. At the commencement of the disease, the patient has commonly a ravenous appetite, eating twice the quantity of food he was accustomed to take when in health, and becoming very fat. When the disease

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* 'An Account of the Native Africans in the Neighbourhood of Sierra Leone,' by Thomas Winterbottom, M.D., London, 1803, vol. 2.

> has continued some time, the appetite declines, and the patient gradually wastes away. Squinting occurs sometimes, though very seldom, in this disease, and in some rare instances the patient is carried off in convulsions. Small glandular tumours are sometimes observed in the neck a little before the commencement of this complaint, though probably depending rather upon accidental circumstances than upon the disease itself. Slave traders, however, appear to consider these tumours as a symptom, indicating a disposition to lethargy, and they either never buy such slaves, or get quit of them as soon as they observe any such appearances. The disposition to sleep is so strong as scarcely to leave a sufficient respite for taking of food; even the repeated application of a whip, a remedy which has been frequently used, is hardly sufficient to keep the poor wretch awake. The repeated application of blisters and of setons has been employed by European surgeons without avail, as the disease, under every mode of treatment, usually proves fatal within three or four months. The natives are totally at a loss to what cause this complaint ought to be attributed. Sweating is the only means they make use of, or from which they hope for any success; this is never tried but in incipient cases, for when the disease has been of any continuance they think it in vain to make the attempt. The root of grass, called by the Soosoos, kallee, and the dried leaves of a plant called in Soosoo, fingka, are boiled for some time in water, in an iron pot; when this is removed from the fire the patient is seated over it, and is covered over with cotton clothes, a process which never fails to excite a copious perspiration. This mode of cure is repeated two or three times a day, and is persisted in for a considerable length of time, until the disease is arrested, or appears to be gaining. No internal medicines are given in the complaint."

Dr. P. A. Guérin, in a thesis on Sleeping Sickness presented to the Paris University in 1869, says, referring to the immigration of Africans into Martinique, in the West Indies—

> "For about 12 years, during a period when the immigration of Africans into Martinique was considerable, we were called upon to treat Sleeping Sickness on the various landed estates, as well as in the civil hospital at Fort de France, in the discharge of our duties."

Guérin selects several from 148 cases treated by him during his stay in the island, and gives full clinical and other data, followed by the results of autopsies. His first case is that of—

> (1) Félise, whose age was about 25, and who had been in Martinique for 5 years. He supplies the results of his daily

observations, and notes especially the various attacks of somnolency, which gradually increase, so as to leave ultimately but few intervals in which the patient remains awake, till January 22, when gradual improvement begins, and continues till March 10, when he is declared fit to resume his work. On September 2, however, 7 months after leaving hospital, he is again admitted with similar symptoms, grows gradually worse, and on October 25, spasms appear, then stupor again, and finally, November 2, without awakening he dies. The period of incubation is apparently 5 years or more.

(2) LOUBENDEAU, brought to hospital on May 11, 1859, three days after arriving in Martinique. The physician on board had noticed his drowsiness a few days after leaving the Congo. The patient died on November 6.

(3) JOSEPH, came to hospital of Fort de France on July 15, 1865. Is 19 years of age, and had arrived in the Colony 5 years previously. He died on October 25. The incubation period again appears to be 5 years, or over.

(4) MATHIEU, a Creole, age 15, resident in Colony 3 years. Towards November, 1863, "seemed to become sad, his manners lazy, his walk and all his motions slow," followed by increasing periods of somnolency till death on June 22, 1864.

(5) NAGOU, a woman, age 17, resident 4 years, admitted May 5, died September 10.

On reading, however, a summary of Dr. Guérin's thesis, published in the 'Archives de Médecine,'* one is led to doubt the diagnosis of many of his cases. So large a number as 148 in Martinique alone during the comparatively short period of 12 years is in itself startling.

In referring to the fact that the cases of Sleeping Sickness treated in Martinique occurred only among negroes who had come to the island from the Congo district, Guérin says†—

> "Not all black-skinned people are equally liable to contract 'hypnosie.' The black Creoles of the Antilles, for instance, have been employed without bad consequences in the factories of the firm Régis, and have never caught it. It broke out, however, with great virulence among the Africans who had come over during the last emigration of blacks from the Congo into the Antilles. Sleeping Sickness has frequently appeared among them, long after their leaving their homes. This peculiarity of affecting only a special group of individuals allows of the assumption that there exists a special predisposition toward the disease among the negroes from the Congo. Nevertheless, the older negroes from

---

* 'Archives de Médecine,' VIe Série, vol. 14, Paris, 1869.

† Thesis.

> the Congo who were landed there in agreement with the treaty, and who have been in the Colony some 40 years, have not a single case to show."

Careful search that I caused to be made among books of travel referring to the West Coast of Africa from the beginning of the 16th century, has failed to bring to light records of the disease anterior to Dr. Winterbottom's account. Dr. Corré, who investigated the literature of the subject, met with no better success, for in 1876 he writes*—

> "Before undertaking my journey into the region of Nelvane, I went through all the books where I hoped to find some information regarding the disease. My researches had a negative result. Labat, who wrote his 'Nouvelle relation de la côte occidentale d'Afrique' on the basis of comprehensive and very well-selected material, and Adanson, who visited Portudal towards the middle of the 18th century, mention nothing that refers to Sleeping Sickness. The books referring to the treatment of the slaves, so rich in horrible details, enumerate the various causes of their mortality, and their diseases observed; some of them speak, it is true, of languor, exhaustion, debilitating causes, physical as well as moral, but nowhere, even in passages quoted from medical reports, is there any mention of somnolency. Nor have books, written in America during the period of slavery, given me any information."

2. GEOGRAPHICAL DISTRIBUTION.

Dr. H. Rey in an article entitled "Maladie du Sommeil" contributed to the 'Dictionnaire de Médecine et de Chirurgie pratiques,' vol. xxxiii (1882), summarises what was known of the geographical distribution of the disease at that date as follows:—

> "Sleeping Sickness has been observed on the whole west coast of Africa from the Portuguese Possessions in the south (Loanda, Benguela), up to the mouth of the Senegal; also on the islands of the Gulf of Guinea (Princes Island, Saint Thomas, Fernando-Po); and finally on the French Antilles among negroes who had come from Africa. At some points the disease occurs with exceptional frequency, as for instance, in Senegambia in the districts of Joal and Portudal; the village of Nianing in the latter is pointed out by Corré as a focus of the malady."

Until 1901 this remained the general distribution of Sleeping Sickness, with the addition that the disease had appeared as far up the

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* A. Corré, "Contribution à l'étude de la maladie du sommeil," 'Gaz. Méd. de Paris,' 1876.

Congo as Stanley Falls; also in 1898 at Jebba on the Upper Niger, Dr. D. Rees had a well-marked case under his care from the Royal Niger Company's Constabulary; and subsequently I had two more cases, one a servant from the coast, the other a Yoruba in the West African Frontier Force, who was in my charge in the Field Force Hospital at the same station.

3. THE OUTBREAK IN UGANDA.

As already seen, prior to 1901, Sleeping Sickness had only been recorded from Western Africa, excepting those cases imported into the West Indies from the Congo. In the early part of that year, reports were received by the Foreign Office from H.M. Commissioner in Uganda, with reference to the apparently widespread epidemic of the disease in the Protectorate.

The first cases were admitted in April, 1901, at the Church Missionary Society's Hospital at Mengo, in the Province of Uganda, an institution that had been in existence for about five years, under the charge of Dr. A. R. Cook and Dr. J. H. Cook. These officers had never met with the disease previously, nor was it known apparently to the natives.

Of the first eight cases, four came from Busoga,* and the natives affirmed that the disease, called by them "Mgota," was much more prevalent in that province than in the Kingdom of Uganda. Later in the year, the cases became so frequent that the missionaries were obliged to refuse them admission to their hospital, and on this being reported to Entebbe, the administrative headquarters of the Uganda Protectorate, Dr. Aubrey Hodges, Medical Officer for Busoga, was instructed to make an investigation, and report upon the disease throughout his district. Towards this end, he made a canoe journey to "the most important places along the north coast of Lake Victoria from Jinja to Nyala, and the chief Busoga, Buvuma, and Kavirondo Islands."† He found that the disease was "most prevalent from Lubas to the borders of Kavirondo, and in Buvuma and the Busoga Islands."‡ In his district alone, 20,000 persons were reported to have already succumbed.

4. THE FORMATION OF A COMMISSION OF INVESTIGATION —INSTRUCTIONS RECEIVED.

As the result of the above reports, and at the instigation of the Foreign Office, a Commission was appointed by the Royal Society to proceed to Uganda for the purpose of investigating the cause of the disease, and as a member of that Commission, I received from the Society in the first week of June, 1902, the following amongst other instructions, under the heading of "Suggestions to Observers":—

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* 'Journal of Tropical Medicine,' July 15, 1901.

† 'Report on Sleeping Sickness,' by Dr. Hodges, 1902.

‡ *Ibid.*

> "Dr. Christy [is] to proceed round [the] north of Lake [Victoria] carefully collecting and examining bloods so as to ascertain where the area of the presence of *Filaria perstans* commences, and where that of Sleeping Sickness commences."
>
> "Dr. Christy having arrived [at Entebbe] should proceed along [the] west shore of Lake [Victoria] examining blood, and inquiring for Sleeping Sickness. Having got to the limit he should return to Mengo (Entebbe) and then start due west investigating in [the] same manner."
>
> "In this way the areas of Sleeping Sickness and *Filaria perstans* will be roughly determined in three directions. Then Dr. Christy should proceed down the Nile towards Egypt on the same quest, and if thought desirable should return home by that way."

5. ROUTES FOLLOWED.

(With Map.)

I left London on June 10, 1902, and, in company with Drs. Castellani and Low, arrived at Kisumu, the Victoria Nyanza terminus of the Uganda Railroad, on July 8. Here I parted with my two colleagues, who went on to Entebbe by steamboat, while I marched overland, through Kavirondo and Busoga, to the Nile at Jinja. From there I travelled the remainder of the way by canoe, reaching Entebbe on July 26.

Not having been able on this short journey to satisfactorily map out the eastern limit of Sleeping Sickness, it was necessary to make a second, and more extended journey, eastwards. For this purpose, I left Entebbe on August 6, and crossing the Nile at Jinja, travelled due north through Busoga, till Lake Kioga was reached, taking blood slides at intervals of from 15 to 20 miles. A little beyond Lake Kioga I found the northern limit of *Filaria perstans*, and touched upon the southern limit of *Filaria diurna*. I, therefore, at this point turned eastward to Mount Elgon. After passing along the western slopes of the mountain with some difficulty, owing to the hostility of the natives, I marched southwards through Kavirondo, taking blood slides at every village where possible, and reaching Mumia's on September 11. Thence I travelled on towards the Victoria Nyanza until I again entered the Sleeping Sickness area, where I spent some time in the worst affected districts, arriving at Kisumu again on September 20. Beyond Kisumu I travelled chiefly by canoe, mapping out the Sleeping Sickness area along the coast towards German East Africa. By arrangement with the authorities I was picked up by steamer at Lusinga

Island, and finally arrived at Entebbe on October 15. From there I made a visit of some days' duration to the badly affected islands of Buvuma and Bugaya.

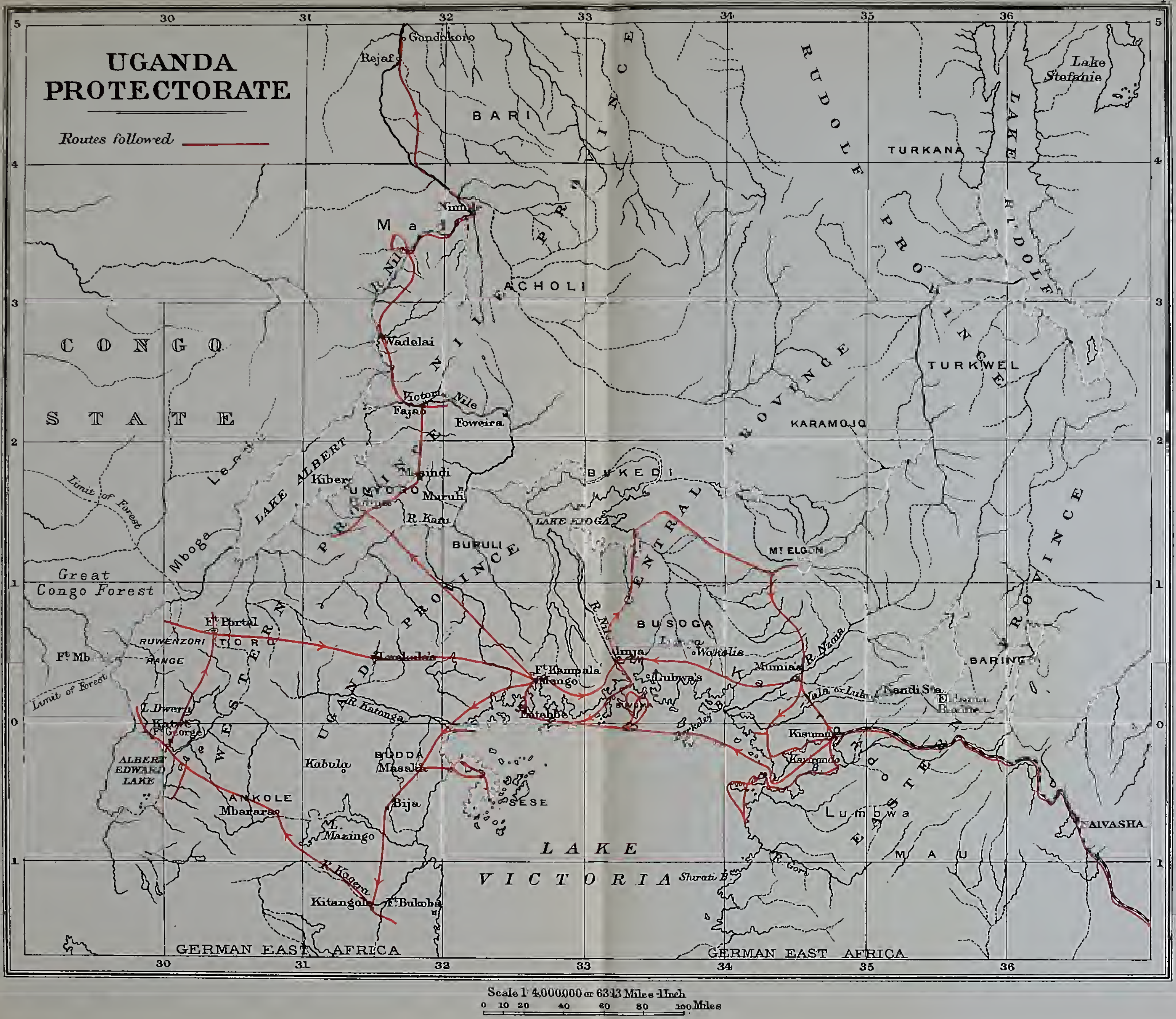
Leaving Entebbe, for my third and longest journey within the Protectorates, on October 30, I marched to Masaka in Buddu, from which place I paid a visit to the Sese Islands, and then travelled on southwards into German territory as far as the Kagera River, on the south bank of which, at Kifumbero (Kitangole), I had the pleasure of meeting Dr. Feldmann, the military medical officer stationed at Fort Bukoba, from whom I gathered much important information bearing upon Filariasis and Bubonic Plague in his district, as well as negative information with regard to Sleeping Sickness.

From Kifumbero I recrossed the Kagera and travelled north-west, through some difficult country, almost without tracks, to Mbarara, the capital of Ankole. Here I remained several days, and with the help of the collector of the district I was afforded an opportunity of explaining my mission to the King of Ankole and his chiefs at a full baraza convened for the purpose. Runners were immediately sent to all the surrounding districts, with instructions to the petty chiefs to send in at once so many men from each tribe, and I was thereby enabled to collect a large number of slides, and a store of information without traversing the whole of the province.

Leaving Mbarara I marched north-west till I reached the Albert Edward Nyanza, being considerably delayed on the way owing to the necessity of making treble marches for some days, the majority of my porters having run away. Skirting the eastern slopes of the Ruwenzori snow range I arrived at Fort Portal, the capital of Toro, on January 1. Here, through the kindness of the collector, I again had an opportunity of explaining my mission to the chiefs, and in the same manner as at Mbarara, obtained a large number of slides from the surrounding districts. I then travelled as fast as possible back to Entebbe, which I reached once more on January 31, 1903.

On arrival I heard that Dr. Low had already returned to England, and that the Royal Society wished me also to return. I had hoped after completing my maps of distribution to have been able to spend another month or so in further studying the etiology of Sleeping Sickness in Busoga and Kavirondo, and its more exact distribution along the margin of the lake.

After 5 days' rest, I left Entebbe *en route* for the Nile on February 6, 1903. On reaching Hoima, the capital of Unyoro, I learnt that owing to the steam launch on the Albert Nyanza being in use, it would be impossible for me to reach Gondokoro in time to catch the next monthly boat for Khartum. I therefore decided to march overland through Msinde, Fajao, Wadelai, and Nimule, to Gondokoro, which place I reached on March 25. By so doing I was able to extend


UGANDA PROTECTORATE
Routes followed
CONGO STATE
Great Congo Forest
Limit of Forest
GERMAN EAST AFRICA
LAKE VICTORIA
LAKE ALBERT
ALBERT EDWARD LAKE
LAKE KIOGA
LAKE RUDOLF
Lake Stefanie
NILE PROVINCE
RUDOLF PROVINCE
CENTRAL PROVINCE
UGANDA PROVINCE
WESTERN PROVINCE
UNYORO PROVINCE
EASTERN PROVINCE
Gondokoro
Rejaf
BARI
Nimule
ACHOLI
Wadelai
Victoria Nile
Fajao
Foweira
TURKANA
TURKWEL
KARAMOJO
BUKEDI
Kiberi
UNYORO
Masindi
Muruli
R. Kafu
BURULI
Mboga
RUWENZORI RANGE
Ft. Portal
TORO
Ft. Mb
L. Dwera
Katwe (Ft. George)
Kasule's
Ft. Kampala
Mengo
Entebbe
R. Katonga
Kabula
BUDDA
Masaka
Bija
SESE
ANKOLE
Mbarara
L. Mazingo
R. Kagera
Kitangole
Ft. Bukoba
R. Nile
BUSOGA
Luba's
Wakolie
Jinja
Lubwa's
Mt. ELGON
Mumias
R. Nzoia
Vala or Lukos
Nandi Sta.
Eldama Ravine
BARINGO
Kisumu
Kavirondo B.
Lumbwa
MAU
NAIVASHA
R. Gori
Shirati B.
Scale 1: 4,000,000 or 63·13 Miles = 1 Inch
0 10 20 40 60 80 100 Miles

my map of Filariasis, not only as far as the northern limits of the Uganda Protectorate, but also for a considerable way into the Sudan, and in addition to make sure that no Sleeping Sickness existed in that direction.

I went on board the river steamer at Gondokoro on March 27, arrived at Khartum on April 10, at Wady Halfa the 14th, Assouan the 16th, and at Cairo on April 18, 9½ months after landing at Mombasa. (See the route map.)

6. SOURCE OF THE OUTBREAK.

No medical officer was stationed in Busoga before July, 1901, and it is not unlikely that Sleeping Sickness may have prevailed in Busoga or in Buvuma Island for years before it was recognised by the Mengo Missionaries. All diseases are much alike to the native mind, and are regarded by him as visitations of evil spirits. The victim affects seclusion, and his superstitious friends make excuses for him. If there is much mortality a movement is made to another district, the people leaving their houses and contents, as well as the standing crops. Should this occur often the district becomes notorious, and an epidemic may be brought to light. Only when the people are hard pressed and their medicine-men have failed them, do they apply to the white man for relief. At all events from 1898—1900 there seems to have been a good deal of distress in Busoga and Buvuma Island, due to famine resulting from drought, and the consequent failure of the banana crop, and other food supplies. This may have to some extent masked a mortality really due to disease, or it is possible that famine or drought may have fanned into a severe epidemic what had previously been a mild and localised endemic, by affording the exact conditions required for the multiplication of the organisms causing the disease, or for the life and multiplication of some insect, or other agency, which conveys it. Spirillum fever in India, always endemic in certain areas, is apt to become seriously epidemic as the result of famine and drought.

Much importance seems to have been attached to the theory that the disease gradually spread, or was imported into Uganda from the upper waters of the Congo. It certainly has not spread across the intervening western provinces, either of Toro or Unyoro, but certain circumstances make it probable that it did come into Uganda from the westward. We know that between the years 1891 and 1895, a large number of Sudanese, with their women and slaves, were brought from the districts to the west of the Albert Nyanza, and settled in Busoga and Uganda under the following circumstances:—

After the relief of Emin Pasha by Stanley in 1888 at Wadelai, the ex-Sudanese soldiers of Emin's province established themselves at Kavali's to the west of the Albert Nyanza, under Selim Bey, living the life of freebooters. Upon the arrival of Captain (now General Sir Frederick) Lugard in Uganda, as the representative of the British East Africa Company in 1890, he soon realised, remarks Sir H. H. Johnston,* that if he was to play a dominant part in the settlement of Uganda, he must have a force of armed men at his disposal who were not Baganda. Accordingly, after the deposition of Kabarega, he proceeded (1891) to the Albert Nyanza, and from there recruited from Lendu and the surrounding districts 400 or 500 Sudanese, the remnants of Emin's army, bringing them, with a rabble of 7,000 wives, followers, and children, into South Toro, where he established them in a newly created kingdom, over which he had placed Kasagama, the present King, but owing to their lawless conduct, the greater part of them, with their locust-like wives and followers, were removed from Toro and placed under better control in Uganda and Busoga in 1892. Subsequently, during the years 1893—1895, many more of Emin's old warriors were recruited and brought, with their women and followers, to Busoga.

That some person or persons with Sleeping Sickness, or carrying the germs of the disease upon them, or that insects, arthropods, or other disease carriers, if there be such in this case, may have found their way into Busoga with these Sudanese, or their Lendu or Congo followers, is not improbable, but there is nothing to point to this theory being correct, except that the time of their immigration corresponds more or less with the probable commencement of the outbreak (1896). At Fort Portal, in Toro, however, I could gather no evidence to show that Sleeping Sickness existed, or had been known, anywhere in the country to the immediate west of the Albert Nyanza, although I questioned several natives and traders who knew that country well. Inquiries were also made for me amongst the oldest and most intelligent of the Sudanese, without gaining any record of the disease, and the officer who accompanied them was able to assure me that there had been no sickness amongst them, or their numerous followers, on the long tedious marches through Toro and Uganda. If the infection reached the Protectorate in this way it came with the followers, and not with the Sudanese themselves, for the latter are almost wholly immune to Sleeping Sickness.

On arrival in Busoga, the Sudanese warriors had no social intercourse with the native inhabitants, who were also looked down upon by the Congo and Lendu people, until after a few years a blood relationship gradually sprung up between them. Consequently, if the incubation period is a long one, as it is believed to be, it might be supposed that, if these people brought Sleeping Sickness with them, the disease would not be likely to appear among the inhabitants of Busoga until after the lapse of several years at least from the date

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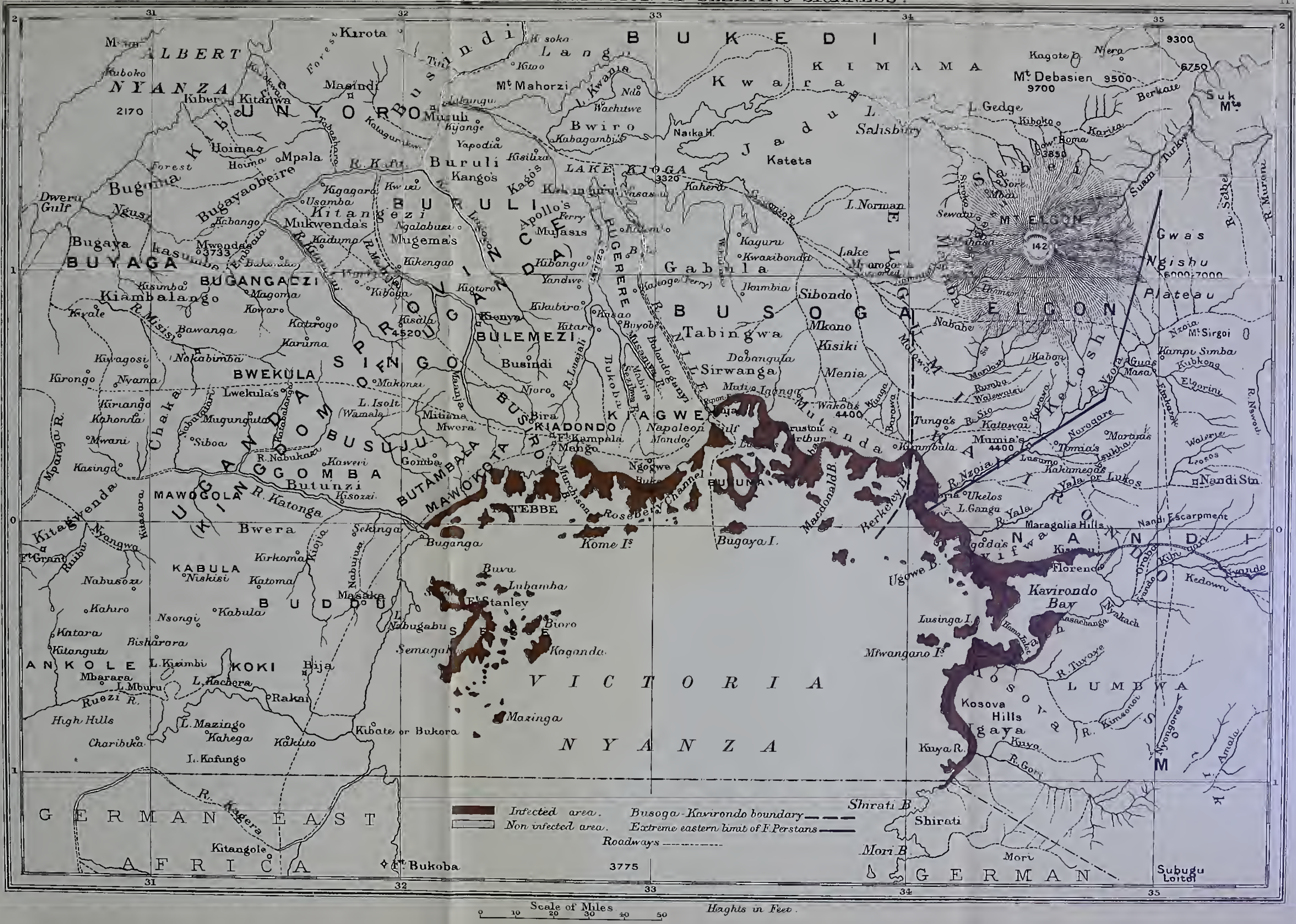
* Johnston's 'Uganda Protectorate,' p. 236.

REVISED DISTRIBUTION OF SLEEPING SICKNESS.



of coming of these new arrivals from the west, and as a matter of fact, five years elapsed before the disease was reported by the missionaries at Mengo.

7. AREA OF DISTRIBUTION.

When the Commission arrived at Entebbe in July, 1902, Sleeping Sickness was thought to be widespread over Busoga and Uganda, but most prevalent in the former province, along the shores of the Victoria Nyanza.* My first journey through Busoga enabled me to satisfy myself that it was not only most prevalent, but was confined to the lake shores. On my second journey I traced it still further along the borders of the lake, from Busoga, through Kavirondo to Kisumu, and far beyond, down the eastern side.

The accompanying map (Revised Distribution of the Sickness) shows the distribution of the disease as I mapped it towards the close of 1902. The darkest coloured portions indicate what I have termed the infective area, or that in which the disease appeared to be contracted.

A. *Infective Area.*

This area consists of a narrow strip of coast line, at its widest not more than 10 miles, stretching along the shores of the Victoria Nyanza for a distance of over 250 miles. It extends from the mouth of the Katonga River, the northern boundary of Buddu, on the west, through Uganda, Busoga, and Kavirondo, to Kisumu on the east, the point at which the Uganda Railway reaches the lake. At Kisumu only two or three imported cases could be found, of which all but one had contracted the disease in Busoga or Uganda. Beyond Kisumu, along the eastern and southern shores of Kavirondo Bay, no cases were met with until reaching the Kasachonga and Homa districts. Passing Homa Inlet, I found that the Kasagunga coast district, opposite Uyoma promontory, and the large island of Lusinga, at the mouth of the bay, were badly infected. No cases were actually seen from Mfwangano Island. From Kasagunga the infective area extended southwards along the eastern shores of the lake, where I traced it to within a few miles of the Gori River. For information as to the occurrence of the disease south of the Gori River, I am indebted to Dr. Lott, the German Military Medical Officer stationed at Shirati, who wrote me on January 12th, 1903, saying that 4 months previous to that date, Sleeping Sickness had never been reported in his district, but that about that date it was said to have been brought by two natives coming from British territory. Altogether, four cases had occurred south of the boundary river Gori, in the Udemi district of the Sultan of Obo. One of these died two months previous to the date of his letter, the other three were isolated. No subsequent cases had come under notice.

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* Report 415, from Dr. Moffatt to Commissioner Sadler, Entebbe, June 17, 1902.

[Dr. Lott also stated that the natives reported that Sleeping Sickness was prevalent in our districts of Kabotschi and Unjama, north of the Gori river.* A similar report was made to me by the Kasachonga people, and the Kisengere people said that there were a few cases a little way inland. Also at Nyacach, at the head of Kavirondo Bay, the chief informed me that he thought the disease was prevalent in the Lumbwa country, and he pointed quite correctly to the south-east, saying it was two days' journey. As the infective area shows nowhere else any tendency to spread beyond a very short distance inland from the shores of the Victoria Nyanza, the above reports of the occurrence of the disease towards the Mau country are of some interest, and I regret that during my visit, I was not able to investigate the matter further. I had not then received Dr. Lott's letter, and I was obliged to be at Lusinga Island upon a certain date in order to meet the steamer on her way to Entebbe. The Lumbwa country was, too, at that time practically unexplored, and to have made a journey through it would have necessitated an expedition on a much larger scale than the Protectorate authorities would have been prepared to sanction.]

The infective area also includes all the islands in the British portion of the Victoria Nyanza, and, judging by investigations I carried out in the Sese and Buvuma groups, it is in the larger islands, probably confined to their margins, in the same way as it is confined to the lake shores on the mainland.

I was not able to visit many of the smaller islands, but I was informed by missionaries and others that all of them were more or less affected, Kome Island the most seriously. The White Fathers of Vitala Maria assured me that in Kome Island even cattle and dogs had died of the disease.

With regard to the western limit of the infective area only a very few cases were to be found or heard of west of Entebbe and Kampala, and none south of the Katonga river, with the exception of three cases at Masaka, which there was good reason to believe had been imported; two cases at Bujaju, the nearest mainland to the Sese Islands, both of which had come from Sese; and one rather doubtful case at Burangoma, a small village not far from Charibika on the hills overlooking the south end of Lake Mazingo, in Ankole. I could gain no information that this case, a boy, had ever left his native village. His father stated that there were two similar cases, but they were not forthcoming, and I was hampered in my search by the want of an interpreter.

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* On Lieut.-Col. Macdonald's latest map, issued by the War Office, which I used during my journeys, the hill district of Kaboshi (doubtless the same as Kabotschi) is marked as being 15 or 20 miles from the lake shore.

Although I travelled, during my 9 months' stay in the country, over the greater portion of the better-known districts of the Uganda Protectorate, as well as the western parts of the East African Protectorate, and into German East Africa, and the Congo Free State, making inquiries of the chiefs and people, coupled with personal investigations, I found no other endemic areas of Sleeping Sickness beyond those on the shores of the lake and in the islands. It does not occur on the Upper Nile or its tributaries, and there seems no reason to believe that it has spread to the Nandi Plateau as has been stated.

B. *Non-infective Area.*

The lighter coloured portions of the Distribution Map, namely, those parts beyond the infective area on the mainland and the interior of the larger islands, indicate the area in which the disease is prevalent, but in which it does not seem to be infective. I have called this the non-infective area. The cases occurring in it are usually isolated ones, scattered here and there, and whole families are never infected. Moreover, in the great majority of these cases a history of the patient having been at or near the lake some months previously can be obtained. I found or heard of a few cases even beyond this area, as far as Tabingwas in Busoga, but all of them had been to the lake. The natives themselves in some districts recognise that the disease is contracted only in districts from which the lake can be seen, and infected individuals frequently volunteered the information that they had been to the lake.

8. INHABITANTS OF THE INFECTIVE AREA.

The area of distribution of Sleeping Sickness in Equatorial Africa is about equally divided between two of the most widely differing types of negroes as could be found in Tropical Africa. To the west of the Usoga-Kavirondo boundary are the provinces of Busoga and Uganda, inhabited by a clothed and fairly civilised Bantu race. To the east of the Usoga-Kavirondo boundary are the Kavirondo, typical Nilotic negroes, unclothed and uncivilised, with language, customs, food, and appearance entirely different from their neighbours to the west of them.

The inhabitants of the islands are in most cases of a type similar to those of the mainland opposite to each.

9. PHYSICAL FEATURES, AND CLIMATE OF THE INFECTIVE AREA.

The Victoria Nyanza is 3,775 feet above sea level. Along most of the northern coast, from the Katonga River on the west, to Berkeley Bay at the Busoga-Kavirondo boundary on the east, the catchment area of the lake approaches to within 5 or 10 miles of its shores, for in this section practically no running streams enter it and only the Nile flows out of it. This portion of the Victoria Nyanza is bordered by hills, for the most part thickly wooded, and rising 500 or 600 feet above the lake level.

The lake shore itself, is in most places low lying and forested, and in inhabited parts it is planted with bananas. Only in the more secluded inlets is there any considerable collection of papyrus, and marsh. Kavirondo is mostly characterised by rolling upland downs, but the coast, here also, for a few miles inland is low lying, and where the Nzoia and Yala rivers enter the lake there are considerable growths of papyrus.

At the head of Kavirondo Bay there is a large area of swamp, at the edge of which are several big villages, inhabited by Kavirondo fishermen, who at the time of my visit had not been attacked by Sleeping Sickness. The south shores of the bay, and the eastern shores of the Victoria Nyanza, are bounded by high grass-covered hills sloping gradually to the lake, with occasional patches of open forest.

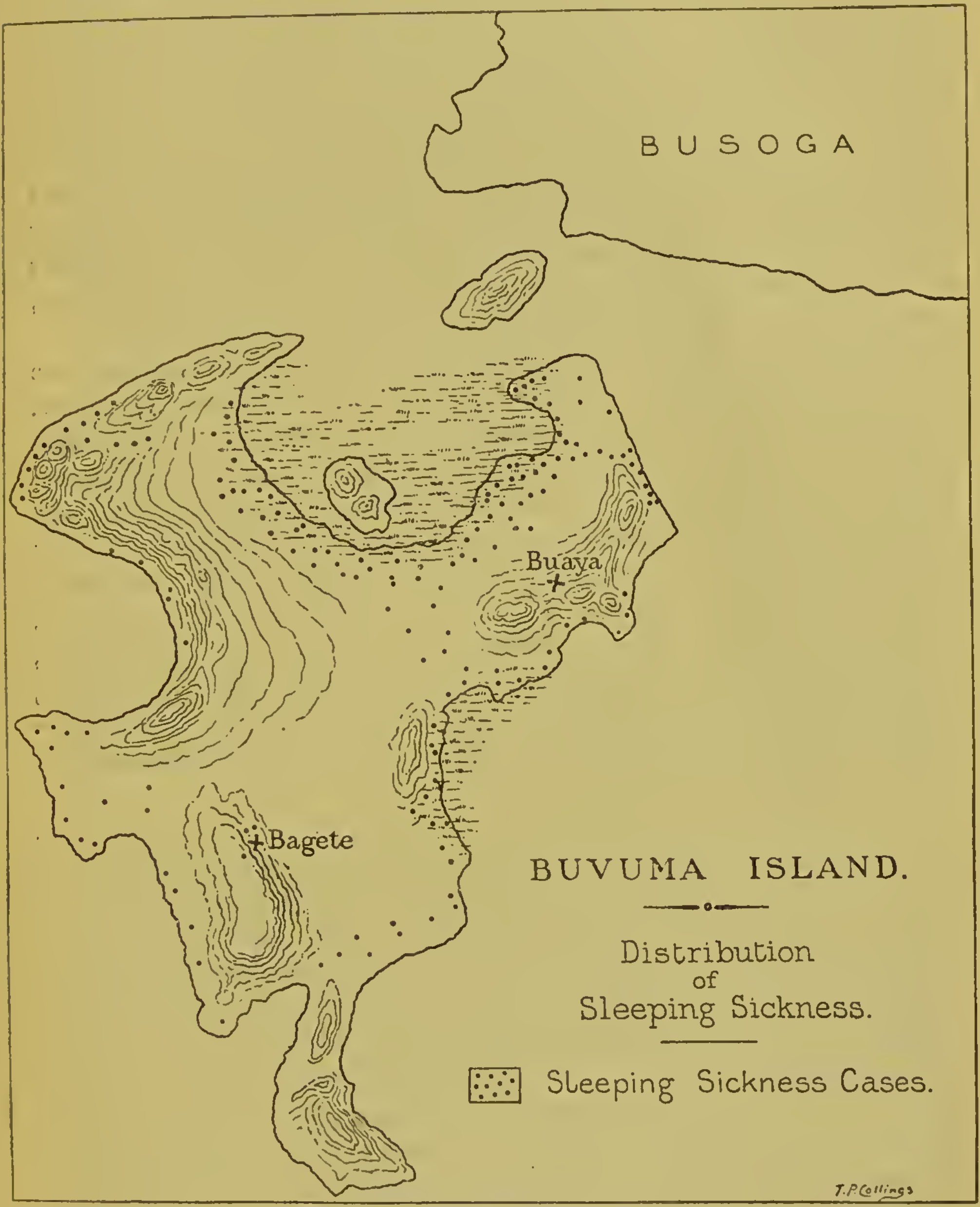
The majority of the islands are high and rocky, and are covered with vegetation; some have patches of magnificent jungle forest in the valleys, and round the margins.

The sun at Entebbe rarely causes any discomfort. The average minimum temperature is about 52° F., and the maximum 81·8° F., and, although it is situated less than 10 miles north of the equator, its climate is much like that of an English summer.

10. CHARACTERISTICS OF INFECTIVE LOCALITIES.

In travelling through the infective area it was frequently noticed that Sleeping Sickness did not affect the inhabitants of all places alike.

The disease was most prevalent amongst the inhabitants of low-lying shambas (banana and potato plantations) in places along the shores of the Victoria Nyanza, or in wooded districts not far from the water. But even in these districts natives who lived in villages, particularly if they were situated on high ground, were much less affected than those living in the shambas; and those living in large compact villages, encircled by the usual high cane structures, were less seriously affected than the occupants of scattered villages in which the huts were surrounded by bananas or forest growth. People inhabiting populous centres, such for instance, as Kampala and Entebbe, were practically exempt, while those living on open grass plains were quite free from the disease.



(Compare Plates 1 and 2.)

In order to study more closely cases of Sleeping Sickness within a circumscribed area, I made a visit of several days' duration to the badly infected island of Buvuma. The accompanying map illustrates one result of the investigation. I was conducted from shamba to shamba all over the island, and found that a large proportion of the huts were empty owing to the death of the occupants, while many of the inhabited ones contained a case or cases of Sleeping Sickness. Practically all the cases were confined to the lower levels of the island, near the water's edge, and the dwellings were surrounded by bananas or forest growth. The village of Buaya, situated on high open ground, did not contain a single case, and only two deaths had occurred amongst the people in the chief's village of Bagete, situated fairly high, but adjacent to forest growth. These characteristics of infected localities in Buvuma held good for all the infective area on the mainland, as far as I was able to observe; for example, at the Roman Catholic Mission station of Nkokonjaro (Kiagwe, Uganda) the Fathers stated that many deaths from the Sickness had occurred in the shambas down near the water, but not amongst those living round the Mission, which was situated on high ground, a mile or two from the lake.

In marked contrast to Busoga and Uganda, the prevailing landscape in Kavirondo consists of rolling downs covered with short grass. The infective localities are (as elsewhere), the districts bordering upon the Victoria Nyanza, and the estuaries of the rivers, where scattered trees and scrub appear, with fantastic candelabra-shaped euphorbias. In Kavirondo, however, the exemption of villages from the disease was less noticeable than it was to the westward, for the reason that nearly every family had a separate village surrounded by a high cane wall, or an enormous floral hedge, and single huts were rare. Here, again, the villages which were situated on high ground and in the open, although within the infective area, were almost exempt, the majority of cases coming from the low-lying scrub country adjacent to the lake and the river estuaries.

It is remarkable that the large number of Sudanese who were brought from Lendu and the Congo (see "Source of the Outbreak") remain to the present time practically free from Sleeping Sickness, although in many instances they have been quartered for years in the infective area. The reason for this lies probably in the circumstance that they live in large, well laid out villages. These "Nube lines," although filthily insanitary on the outskirts, are exceedingly clean and neat within. The huts are in rows, and no vegetation is allowed to grow up near them. The streets are 10 or 20 feet wide, and are swept daily. Each man has several women belonging to him, whose duty it is to keep the floors and doorway carefully and regularly cow-dunged once a week or oftener. Doubtless the partial exemption of these Sudanese from *F. perstans* may be accounted for in the same way. Many of the slaves and people who followed them into Busoga reverted to their original condition as workers, and they or their descendants are to be found living amongst the shambas in the neighbourhood of the lines. These have suffered as much from Sleeping Sickness as the original inhabitants of Busoga.

11. Progress of the Epidemic—Direction of Spread.

At Jinja Dr. Hodges informed me (July, 1902), that he believed that the original starting point of the epidemic was Wakolis in Busoga, and he stated that native report said that it had commenced there six years ago (1896). When I passed through Wakolis, which is situated some 15 miles from the Victoria Nyanza, and well outside the present infective area, the old chief insisted that there were then no cases of Sleeping Sickness, and I found none, but there had been cases some time previously. What spot was first infected it is now impossible to say, but in all probability the epidemic did start somewhere in Busoga, or in the neighbouring island of Buvuma.

From Busoga the epidemic has travelled east and west, both along the mainland and the chain of islands. Westward, on the mainland, it seems to have spread with some amount of virulence as far as Kampala and Entebbe, but beyond these places little was to be heard of the disease, and only a few indigenous cases were to be found, as far as the Katonga river, where the infective area apparently ceased. It seems, however, to have spread with much more virulence along the chain of islands westward until it reached the Sese group. The White Fathers in Sese stated that they believed the infection had been brought from the islands to the north, with which there was constant communication. The infection certainly could not have reached them from the adjacent Buddu coast, where, with the exception of imported cases, the disease was not to be found. The White Fathers also stated that the first cases in Sese occurred 11 months prior to my visit (November, 1902).

I was not able to visit many of the islands besides Sese and Buvuma, but several of my informants were of opinion that those off the Kiagwe coast, especially Kome, were infected some time before the mainland, which I think is probable, because a good deal of traffic exists between the islands, but less between them and the mainland.

Eastward, from Busoga, the epidemic spread along the mainland and the islands into Kavirondo, with much greater virulence than it had shown in travelling westward, and when I left Uganda it was extending its area down the eastern side of the lake. The first cases in Southern Kavirondo occurred 11 months prior to my second visit, and the natives believed that it had been introduced by Busoga canoe men.

On reaching the infected regions south of Kavirondo Bay (September 26, 1902) I learnt that in Kasagunga the first cases had occurred about 9 months previously. That the epidemic had crossed the mouth of the Bay at its narrowest part seemed to be proved by the statements of the natives that the first cases in the districts (Lusinga Island and Homa) on each side of Kasagunga, which is only 3½ miles from Uyoma promontory, had occurred 3 months subsequently to those in Kasagunga itself.

If the foregoing results of this tiresome investigation are approximately correct, the dates at which the epidemic reached the various places in its progress would be as follows :—

Some part of Busoga or Buvuma Island, 1896 (Dr. Hodges).
Kampala (Mengo), February, 1901.
Southern Kavirondo, October, 1901.
Sese Islands, December, 1901.
Kasagunga, January, 1902.
Lusinga Island, March, 1902.
Kasachonga (Homa), March, 1902.
Kisengere, ? May, 1902.
German East Africa, September, 1902.

The attached map ("Progress of the Epidemic") will, perhaps, show the progress of the epidemic more clearly than the above.

12. INFLUENCE OF SEX, AGE, OCCUPATION, AND SOCIAL POSITION.

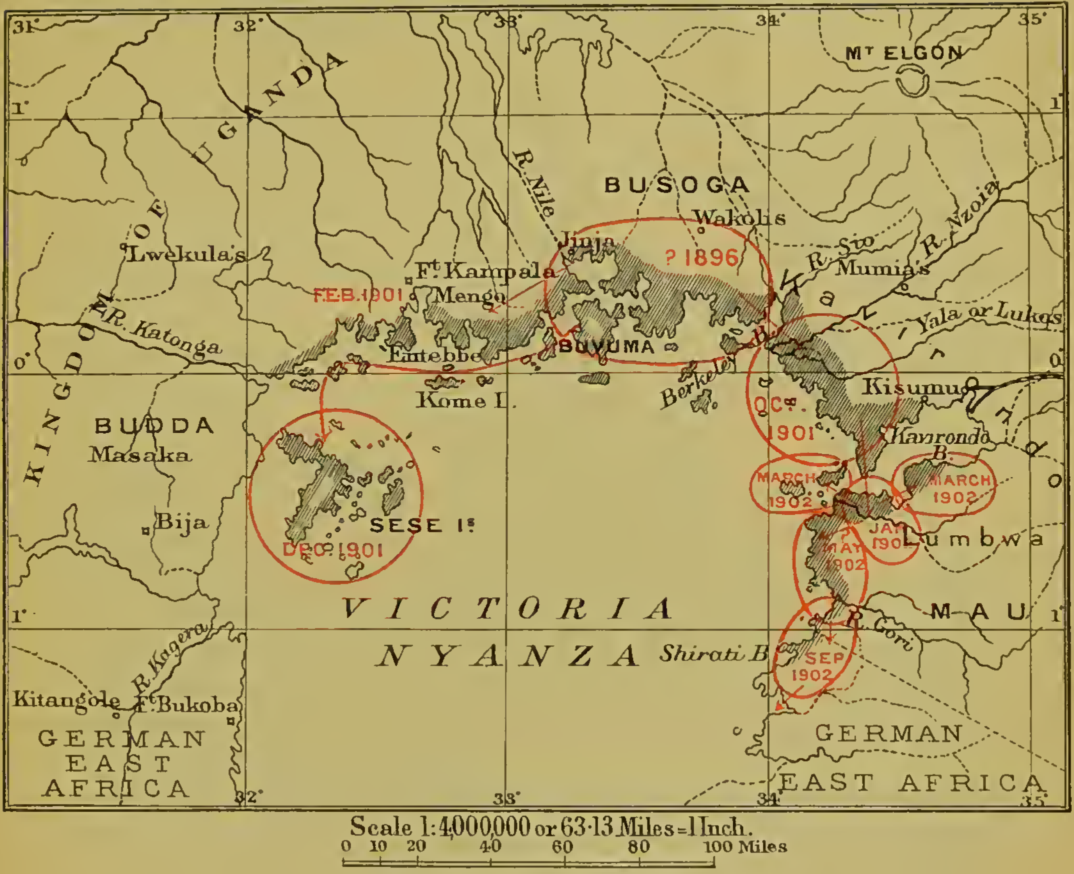
The disease appears to attack both *sexes* in equal proportion, but it may be noted that in Buvuma the people insisted that at the beginning of the epidemic in that island only men were attacked; however, as they could not tell me precisely when the epidemic broke out, I attached little importance to their statement.

Age has apparently no influence upon the disease. I saw many children not more than 18 months or 2 years old obviously affected, but none younger than this. It is probable, however, that children may contract the disease at a very early age, but owing to the long incubation period they do not exhibit symptoms until after 18 months or more. In at least two instances I met with children with no obvious symptoms, but with a suspiciously well-nourished appearance under the most adverse circumstances, while their parents were dying of the disease close by. At a shamba in Buvuma I saw three little children, with this appearance, playing outside a hut in which the father was lying in an advanced stage of the disease; in an adjacent hut lay a woman in the last stage, with terrible ulcers on her thighs and ankles; while in a field close by was a youth, also in a late stage, unable to stand, crying and talking hysterically, as he endeavoured to scoop a hole in the sun-baked ground in the hope of finding one last remaining sweet potato in a patch long out of cultivation.

The influence of *occupation* seems to be considerable. The large majority of cases occur among agriculturists, and those who live in the shambas, and on inquiry it was found that many of the cases that

PROGRESS OF THE EPIDEMIC.

III



Scale 1:4,000,000 or 63·13 Miles = 1 Inch.

occur in villages are of the poorest class, and work in the fields all day.

Chiefs, and the majority of the better class natives, live in the villages, and consequently are less affected by the disease. The Sub Commissioner for Busoga could only give me the two following instances of chiefs having died of Sleeping Sickness. Mbanda, a regular visitor to Jinja Fort on Sundays, was one day noticed to be asleep during the holding of a court, and when taxed with inattention his people admitted that their chief had "Mgota." He died of the disease 6 months afterwards. The petty chief Lukalanga (an incorrigible drunkard) succumbed after only 4 months' illness.

13. Influence of Seasons, Food, and Drinking Water.

I could not trace any connection between Sleeping Sickness and the wet and dry *seasons*, nor could I gather any information from the natives which pointed to the disease being more prevalent at any particular time of the year, and the fact that the duration of the attack extends over several months would make this unlikely. The wretched victims, whose sensibility to cold is much increased, are perhaps more in evidence during the hot dry weather, for they are then induced to crawl out of their huts and lie in the sun.

There is no article of *food* used in the infective area which is peculiar to it. The Baganda live almost wholly upon bananas, which are picked green, peeled, and steamed in an earthenware pot over a slow fire. The staple article of diet of the Kavirondo is grain, chiefly "dura" (millet), to all appearance the same plant as the Indian "duari." It is ground into flour and made into a sort of porridge, or into dampers and cakes. The Kavirondo will also eat almost any kind of meat or dried fish, and in the cattle-grazing districts quantities of milk and butter are consumed.

Dried fish is the only article of diet used throughout the infective area. The smaller fish, the young of a species of perch,* are threaded on sticks and dried in the sun; the larger fish (mostly of the same species) are opened, cleaned, and smoked over a wood fire. I have seen these cured fish all over the country far outside the Sleeping Sickness area. Fish have been suspected by the medical officers of the Protectorate, as well as by the natives, as the cause of the disease, because of the close association of the latter with the shores of the Victoria Nyanza. If fish-eating were the cause, the province of Buddu would not be exempt, and Europeans would before now have become infected.

That the Victoria Nyanza has some very direct influence upon the disease is clear from a study of its distribution, but that it is caused by drinking the *water* of the lake is highly improbable, for many of the inhabitants of the infective area get their supply elsewhere, from streams, ponds and springs, while at Entebbe, which is practically surrounded by the lake, both Europeans and natives use the lake water for all purposes, yet the disease is not to be found in the town itself.

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* Identified by Mr. Boulenger, of the British Museum, to whom I submitted a specimen, as *Talapia galilœa.*

14. PROPAGATION CHARACTERISTICS.

A very little observation shows that Sleeping Sickness is not contagious, as we usually accept the term, and that it is only infectious in a limited sense. A person suffering from the disease, who travels to a district beyond the known infective area, does not convey it to persons in that district unless the conditions, whatever they may be, are favourable to its propagation, and that district must apparently be one bordering upon the Victoria Nyanza. If, however, an infected person travels from one part of the infective area to another, or into regions beyond, which, although previously uninfected, contain the conditions favourable to its propagation, then he becomes a source of danger to all with whom he comes in contact, much in the same way probably as a person suffering from malaria. As is known, if the malarial subject reaches a camp or district in which a suitable species of mosquito occurs, then, at a certain stage in his attack, he becomes a danger to those around him, and still more so to those who come after him. If, however, he camps in districts not inhabited by a suitable mosquito, he may have recurrent attacks with impunity to other people. Without a more competent interpreter than I had, it was impossible for me to ferret out sufficient detail to make a reliable computation of the dates at which the various members of a household or of a district became infected, and of their relation to each other, but the sum of my investigations has led me to believe that the method of propagation is somewhat similar to that of malaria.

Throughout the non-infective area one hears of deaths of persons who had contracted the disease within the infective area, and cases are met with which have developed the disease months after leaving that area. They are almost invariably single cases, which do not seem to have infected other persons in the household or the neighbourhood, and they cause no alarm.

The following is the best authenticated example, amongst several related to me, of the infectiousness of Sleeping Sickness within the infective area, and of its non-infectiousness outside that area:—

Overlooking the Ripon Falls is Jinja Fort, built by the Subommissioner for Busoga, amongst whose people were three young girls A., B., and C., who had been there, he told me, since 1898.

They all three occupied the same room. B.'s parents lived near the Mpologoma River, 60 miles or more from the Victoria Nyanza. C.'s home was a shamba near the lake. In July, 1900, B. and C. went to C.'s home, the shamba near the lake, for a month's holiday. About March, 1901, 8 months afterwards, C. was noticed to be peculiar in her manner. She laughed and cried without cause, talked queerly, and seemed very weak. She was, therefore, sent home, and subsequently caused her people a great deal of trouble through her antics and annoying conduct. Eventually she became too weak to stand, and died 3 months after reaching her home. All her family have since died of Sleeping Sickness.

B. was sent to her home, 60 miles from C.'s home at the lake, suffering with the disease, in January, 1902, 18 months after visiting the lake. She was noticed to be very quiet, said very little, and was drowsy. She died 4 months after reaching her home. For a month previous to her death, she was unable to speak, and if spoken to would open her eyes and perhaps make signs. She could neither stand nor walk, but her faculties were clear till death. Her people were all healthy, and no other cases had occurred in the district (September, 1902).

A., who had lived in such close contact with these two girls, sleeping with them in the same room for so many months, both before and after B. and C. were known to be infected, was perfectly healthy at the date the story was related to me. No other cases of Sleeping Sickness occurred, either before or since, in the fort.

The Sese Islands, about 5 miles distant from the Buddu coast, have been badly infected since the end of 1901; and yet, although there existed, in spite of precautionary measures, a considerable amount of traffic across the intervening portion of the lake, the epidemic had not spread to Buddu, the necessary favourable conditions apparently being absent there. On the other hand, the epidemic, comparatively early in its history, as soon as it reached the Uyoma promontory, in its rapid extension eastwards, crossed the mouth of Kavirondo Bay, a distance of 3½ miles, into the Kasagunga district, although the traffic from shore to shore at this point was, according to native testimony, very infrequent. In this case the necessary conditions for the propagation of the disease must have been present on the southern shores of the bay, the disease itself being probably brought over by some infected Basoga or Kavirondo native, for the people in Kasagunga and Lusinga Island would not admit that they themselves ever went across.

The infective area does not spread along caravan tracks or roadways, and the occurrence of four imported cases at Mumia's, in Kavirondo, and two or three cases along the main road from Busoga to that station, was the only instance I met with in which a road contributed to the spread of the disease, but in this case it only aided the transport of infected individuals, and not the extension of the infective area. Nor does it show any tendency to spread along the course of rivers beyond their estuaries. The disease was prevalent at Ripon Falls—the "birth of the Nile"—but I could not gather that it had extended for more than a mile or so northwards along that river. It is not found, as far as I know, on the shores of any of the other great lakes.

During the early stages of my investigation I formed the belief that the infective agent, whatever it might be, existed in the huts of the natives, but I subsequently saw reason to modify my views upon this subject. If it were so, the houses of the White Fathers, which are usually large, sun-dried brick structures, could not escape infection, for the missionaries live in very close relations with the natives, their churches and mission houses being crowded daily with men, women, and children, some of whom are probably infected; moreover, they visit cases which occur in the shambas, sit with them, and attend to their wants, yet there is no record in Uganda of a missionary, or any European, having contracted the disease. In the Semi district, of Kavirondo, where the disease was much more virulent than to the westward, 30 or 40 per cent. of the inhabitants being infected, and where missionaries are unknown, I camped several times, as malaria seemed rare, in the midst of huts containing Sleeping Sickness cases, and spent days, both in Semi and Buvuma, turning out their contents, sketching, photographing, and examining implements and utensils. There seems, therefore, strong presumptive evidence that the infective agent is at any rate not a blood-sucking insect or arthropod inhabiting the huts.

All the evidence I have been able to gain points to the infective agent being something which frequents the low-lying shambas, and the forested or scrub-covered country along the shores and inlets of the Victoria Nyanza and its islands, but the question arises, should this view be correct, why it is that missionaries, and other Europeans, who have occasion to pass through or spend their time in shambas within the infective area do not become infected? Possibly, in their case, clothing acts as a protective. With a view to seeing whether mosquitoes were implicated, I made a large collection of them in all parts of the country traversed. Since their identification, I have made a study of the distribution of each species, and it is clear that there is no species whose distribution in any way corresponds with that of Sleeping Sickness.*

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* See Report on the Collection by F. V. Theobald, Esq., M.A., B.Sc., p. 33, *infra*.

15. IMMUNITY, AND INFLUENCE OF RACE.

The fact that the Nubian police, the remnants of Emin Pasha's Sudanese, are practically immune to Sleeping Sickness, as already mentioned, would seem to indicate that race may have some influence upon the disease. This, however, is probably not the case, for the infective area is divided between two widely different races of negroes (see section "Inhabitants of the Infective Area"), those on the east of the Busoga-Kavirondo boundary being closely related to the Nilotic races from which the Nubian police were recruited, yet their kinship has not saved them.

The people in Buvuma Island asserted, and it was well known, that the Baganda living in the island were not seriously affected by the disease, whilst the Bavuma themselves were decimated by it. But the explanation is probably to be found in the fact that the Baganda, the conquerors of the Bavuma, belong to the better classes and live in the villages, while the original inhabitants live and do most of the work in the shambas.

It is possible that race influence may have some bearing upon the length of the incubation period and the character of the symptoms, but upon this subject I can give no definite information.

16. SEVERITY AND DIMINUTION OF THE EPIDEMIC.

At what I may call the head of the epidemic, or that district in which the disease was most virulent, namely, in Kavirondo, and to the eastward, not only were cases more numerous, but their duration was much shorter, and the symptoms far more acute, than in Busoga and Uganda. In Kavirondo, hysterical excitement, violent mania, and harmless dementia, were common, and the duration averaged between 4½ and 5 months. In Busoga, and Uganda, the disease had considerably diminished when I passed through, both in number of cases and severity, and the duration was from 6 to 8 months, even 13 and 14 months was not uncommon. Here also the majority were not typical cases, somnolency being frequently almost absent until the late stages developed.

17. *Filaria perstans.*—ITS CONNECTION WITH SLEEPING SICKNESS—ITS DISTRIBUTION, ETC.

On reaching Uganda it was my first aim, as instructed, to map out the area of distribution of Sleeping Sickness, and afterwards that of *F. perstans*, in order to see if the two areas in any way corresponded, as they were supposed to do.

Travelling eastwards from Entebbe it was found that all through

Uganda and Busoga, *F. perstans* was common. From 60 to 80 per cent. of both men and women harboured the parasites; but once past the Busoga-Kavirondo boundary the percentage dropped abruptly to 14 per cent. and then to 5 per cent., a fact first noted by Dr. Hodges, who, however, was not able to travel far enough beyond his district into Kavirondo to reach the limit. Still further east, beyond the Nzoia river I found that *F. perstans* was entirely absent, even in districts where Sleeping Sickness was affecting nearly half the population. I took several hundred blood slides in Southern Kavirondo east of the Nzoia river without finding a single embryo. My discovery (September, 1902) of the total absence of *F. perstans* in Southern Kavirondo was afterwards confirmed by Dr. Wiggins, then recently appointed medical officer at Kisumu, who, after travelling with me along the south of Kavirondo Bay, to the Kasagunga district and Lusinga Island, on his way back to Kisumu, made his first journey through the parts infected with Sleeping Sickness on the north of the bay, and collected his first blood slides. He wrote me (October 12) that he had taken many slides, but found no *F. perstans.* The total absence of *F. perstans* prevailed, I found, far beyond Kavirondo Bay, and down to the eastern shores of the Victoria Nyanza; it probably does not occur anywhere in the East African Protectorate, westward of the Nzoia river.

This important discovery, that Sleeping Sickness extended along the lake shores for more than 100 miles beyond the extreme easterly limit of *F. perstans*, enabled me to send to the Society, on October 31, 1902, the first proof that the two diseases are not connected with each other.

The area of distribution of *F. perstans* extends over the whole of Busoga, Uganda, Buddu, part of Ankole, Toro and Unyoro, as far as the Albert Nyanza, 150 miles north-west of the Sleeping Sickness area. I also traced it into the Congo Free State, and found a few cases on the Nile at Wadelai, and again at Gondokoro. If *F. perstans* were the cause of Sleeping Sickness the disease would have spread far and wide from the shores of the Victoria Nyanza.

Again, in Buvuma and other places I took a large number of blood slides, both from Sleeping Sickness cases and from persons apparently free from the disease, and found that the percentage of *F. perstans* in each case was practically equal; I have yet to complete the compilation of some statistics upon this matter.

It is interesting to note that I found three spots in the Protectorate, far outside the Sleeping Sickness area, where the blood of the natives was so full of embryo filariæ that 100 or more of them could be counted in most of the slides, and yet there were no signs of Sleeping Sickness amongst the inhabitants. On the other hand I found no place in the Sleeping Sickness area where anything like so large a number could be found in any one slide.

During my tour through the lake regions, and for a considerable distance down the Nile into the Sudan, I was able to collect blood slides at the majority of my camps, as well as from natives sent to me from outlying districts by arrangement with collectors and chiefs. The total number of persons, whose blood was examined microscopically for *F. perstans*, amounted to over 5,800, from 155 different places, a success far beyond my original expectations, for I had to travel through several districts only visited previously by one or two Europeans, and some also in which the natives were hostile. With the material gathered I have been able to completely map out the areas of distribution, in British territory, not only of *F. perstans*, but of other species of Filaria, and also to collect a large amount of information bearing upon the general subject of Filariasis.

18. CLINICAL OBSERVATIONS.

I do not enter minutely into the clinical features of Sleeping Sickness, for this part of the work of the Commission was undertaken by my two colleagues, who remained in Entebbe, and had many cases under their care in a special hospital. As, however, during my several journeys, I had opportunities of studying a very large number of cases in their own homes, amidst native surroundings, the following notes may be of some interest:—

With regard to the *incubation period* I have shown (see "Propagation Characteristics," histories of A., B., and C), that it may be as short as 8 months, or as long as 18 months. Little is known as yet of the *premonitory symptoms*, but I may state that towards the termination of the incubation period a gradually increasing lassitude and weakness of the limbs occurs, and afterwards frontal headache.

A. *First Stage—First Month of the Attack.*

As the attack developes the headache increases, the patient becomes morose and slow in his movements, is disinclined to work, and wears a pained, frowning expression, which can be at once recognised as absolutely characteristic of the sickness at this early stage. Later, a certain vacancy is added to his expression, the lower lip becomes puffy and drooping, the general weakness increases, he continually wants to sit down, and frequently dozes, he complains of pain at the back of his neck, in the ankles and elsewhere, his tongue is tremulous, and his hand grip is weak and unsteady.

B. *Second Stage—Second Month of the Attack.*

In this stage the drowsiness and weakness go on increasing, the face becomes puffy, the lower lip more swollen and drooping, the expression vacant, almost idiotic, the skin dry and scaly, speech thick and husky, marked tremors in the muscles develop, frequently more noticeable on the left side, the movements of the hands are jerky, an apparent heaviness and drooping of the upper eyelids is conspicuous, and saliva dribbles from the corners of the mouth or over the puffy lower lip. As this stage progresses the whole body becomes puffy and bloated, as well as the face, and somnolency is a troublesome feature. (*Cf.* Plate 3.)

C. *Third Stage—Third and Fourth Months of the Attack.*

During the third stage the symptoms are all intensified, the weakness becomes so great that the patient is obliged to walk with the help of a stick, and often, instead of sitting down, falls in a heap without attempting to save himself. The somnolence may now be almost continuous, the skin, from want of attention and weakened vitality, has become covered with craw-craw and filthy, and the tremors in many cases are choreic. As time goes on the puffy, bloated appearance of the body subsides, emaciation sets in, and he lies on his side with his limbs flexed, oblivious of everything around him, utterly unable to help himself, and only returning to partial consciousness if roughly shaken.

D. *Final Stage—Fifth or Sixth Month of the Attack.*

During the final stage (Plate 4) the wretched being becomes emaciated and filthy in the extreme, extensive ulcers develop on the hips, ankles, elbows, and other parts, urine and fæces are passed under him, and he lies in a deeply lethargic condition until death supervenes.

This will give some idea of the progressive stages of the disease as I saw it in Kavirondo, where the epidemic was most severe, the duration of the cases comparatively short, and the symptoms well marked. To the westward, in Busoga and Uganda, where the epidemic had to some extent diminished, each stage of the disease was lengthened out, all the symptoms were less marked, and some of them were absent.

In Kavirondo, violent excitement, and other head symptoms, at the very beginning of the attack, seemed more frequent than elsewhere. At one of my camps in that country, a powerfully-built man, with the characteristic facies of the earliest stage of the disease, whom I had noticed hanging round the outskirts of a crowd of natives, amongst whom I was taking slides, suddenly made a leap into the crowd and struck out right and left with a native hoe, creating a momentary panic, during which my table and slides were upset. He was soon overpowered by his friends, however, but not before he had cut open the heads of two of them, and was carried away struggling and shouting to a small village close by, where I heard him raving till the early hours of the morning. On questioning the people, they stated that he had been quite well till three days previously, when he had had a similar attack. During the struggle he was in a state of tense priapism.

Cases of crying and laughing, and weak hysterical excitement, were, perhaps, more common in the second stage, and were frequently seen elsewhere than in Kavirondo. Nystagmus I never observed. The muscular tremors increase gradually from an early stage, occasionally distinct rhythmic waves of contraction can be seen running from one end of a muscle to the other. A high pulse rate is a nearly constant feature throughout the attack, and, I believe, an early symptom. Puffiness of the face, and particularly of the lower lip, is also a constant feature; in many cases the tongue is swollen and protruded (see Plate 3), and the eyeballs prominent, as in exophthalmic conditions.

The distension of the abdomen, and the puffy bloated appearance of the whole body in the second stage, in the majority of cases, gives place, during the third stage, to wasting and emaciation, particularly in Kavirondo. In Buvuma and the Sese Islands, however, where this bloated appearance was far more common than elsewhere, some of the cases showed no signs of emaciation, not even in the last stage, and somnolency in them was not a marked feature. In these cases also the appetite, which always remains good till the third stage, when weakness and somnolency gain the upper hand, might be described as ravenous, and remains so till death occurs. In Buvuma and Sese Islands I saw cases in the last stage so weak that they could hardly lift a hand, and yet were so bloated as to appear only in the second stage of the disease. They were drowsy but not somnolent, and their friends complained that they could not get enough food to satisfy their inordinate hunger.

Many cases, particularly those of the bloated type, when sitting on the ground adopted a characteristic attitude. The legs were separated and extended in front of them, the arms hung by the side, the head was bent forward, and the ropy saliva dribbled down the distended belly, or streamed on to the ground between the legs.

Symptoms of a peculiar nature, bordering upon a cataleptic condition, were frequently to be seen. For example, a patient who yawned and stretched his arms would sometimes forget to withdraw one of them, and it might remain in its extended position for 10 minutes or more; or he would be in the act of feeding himself, and, instead of bringing his fingers to his mouth, would doze off and let the hand remain half-way up to his face for some minutes, or until his next interval of wakefulness. In Buvuma an old and very emaciated woman, who died while lying in front of my tent, held up her arm, in a position possibly intended to shade her face from the sun, without moving it for fully an hour before she died.

A particularly intelligent native chief commented on the disease as follows: "Mgota comes very slowly, it catches one man and he dies, then catches another man who dies, then another. It makes one man very fat, another very thin, and some to eat very much."

Glandular Enlargements.

The early records relating to Sleeping Sickness mention enlargement of the cervical glands as having a connection with the disease, and there is no doubt that there is some intimate association, for I have discovered that the area of distribution of enlarged cervical glands in Equatorial East Africa agrees with that of Sleeping Sickness. During my four journeys in the Protectorates I examined the neck of every man, woman, and child, from whom I took a blood slide, for enlarged glands, and from the extensive tables I have in hand, compiled from this material, together with the results of the examination of many hundreds of natives from whom I could not obtain slides, or had sufficient, I am able to show that the two areas practically correspond. The region of enlarged cervical glands stretched inland a little further than that of the non-infective area of Sleeping Sickness, and from that point the proportion of enlarged glands in the general population increased as one neared the Victoria Nyanza, the highest proportion, together with the greater enlargement, being on the islands. Beyond the agreement between the two areas, there seemed no further connection between Sleeping Sickness and enlargement of glands, for although the majority of cases of the former had firm, and freely movable, glandular enlargements in the neck, and some of them all the superficial glands in the body enlarged, yet there were many cases with no enlarged glands whatever. Again, in several places within the infective area where I was able to line up in front of me several hundred natives, I first picked out all those whose pulse rate was above normal, and then examined them for enlarged cervical glands. Here, also, there seemed no agreement, for some of those selected were without any enlargement, whilst many of those who showed no increase of pulse rate had enlargement. If enlargement of the cervical glands is a symptom of Sleeping Sickness, it is possibly one which develops before the pulse rate is influenced.

It will be seen on reference to the second map, "Revised Distribution of Sleeping Sickness," that the western limit of the infective area is at the Katonga River. During my investigation a remarkable fact came to light with regard to the inhabitants of the country beyond that limit, namely, that south of this river the proportion of enlarged cervical glands lessened almost as abruptly as the proportion of *F. perstans* lessens beyond the Busoga-Kavirondo boundary. Instead of enlarged cervicals, 80 to 90 per cent. of the inhabitants in the districts south of the Katonga, namely, Buddu, Sese, Ankole, and

German East Africa, had enlarged parotids, and often submaxillary and sublingual as well. At some places, noticeably at Masaka in Buddu, it was difficult to find a native without a considerable swelling at the angle of the jaw, on both sides alike, as in mumps, a disease said by the medical officers to be common in Uganda, although I did not meet with it; in no case of enlarged glands at the angle of the jaw did I find a temperature above normal, although I examined many. (See Map "Distribution of Enlarged Glands.")

I further discovered that there existed in Buddu, in the heart of Africa, a focus of genuine bubonic plague, as Koch some years ago pointed out was the case in German East Africa.* Annually, small epidemics of very virulent bubonic plague occur in Buddu, causing the death of many natives, sometimes even of a whole village. In 1901, after a heavy mortality amongst the natives of a large missionary station, and the death of one of the White Fathers, the station was closed. Subsequently, it broke out at Fort Bukoba, in German East Africa, resulting in its temporary evacuation.

The symptoms of plague in this area of enlarged parotids, as far as I could gather, are, judging from experience in Bombay, similar to those of plague in India, with one suggestive exception, namely, buboes beneath and at the angle of the jaw are common.

I hope to be able to present to the Society further details with regard to the distribution of enlarged glands, in a subsequent report dealing with my work on the description and distribution of Filariasis in Equatorial East Africa.

19. MORTALITY.

Sleeping Sickness is generally believed to be always fatal, but on two or three occasions I met with persons who were willing to vouch for a recovery. The Busoga Chief, Baldani, known to the Sub-Commissioner of that district since 1890, was reported in December, 1901, to be suffering from "Mgota," and when seen he and his people admitted the fact, he himself stating that all his women had left him. He was then apparently in an advanced stage, yet, when seen by the Sub-Commissioner, 6 weeks later he appeared to be in perfect health. Histories of apparent recovery such as this are not uncommon in Uganda, but I believe they are only transient recoveries, the disease remaining quiescent for some weeks or months, after which a relapse occurs and death results.

The infective area extends for a distance of over 250 miles along the borders of the Victoria Nyanza, and no possible estimate of the total mortality could be anything more than mere guess work, but I believe it has been much greater than has been generally recognised. If one travels off the main road, visiting the shambas one by one, and entering the huts of the natives, as I have done, scores of cases will be found, previously not owned to by the chief, or native guides. The disease has decimated the population of many of the islands as well as considerable areas on the mainland.

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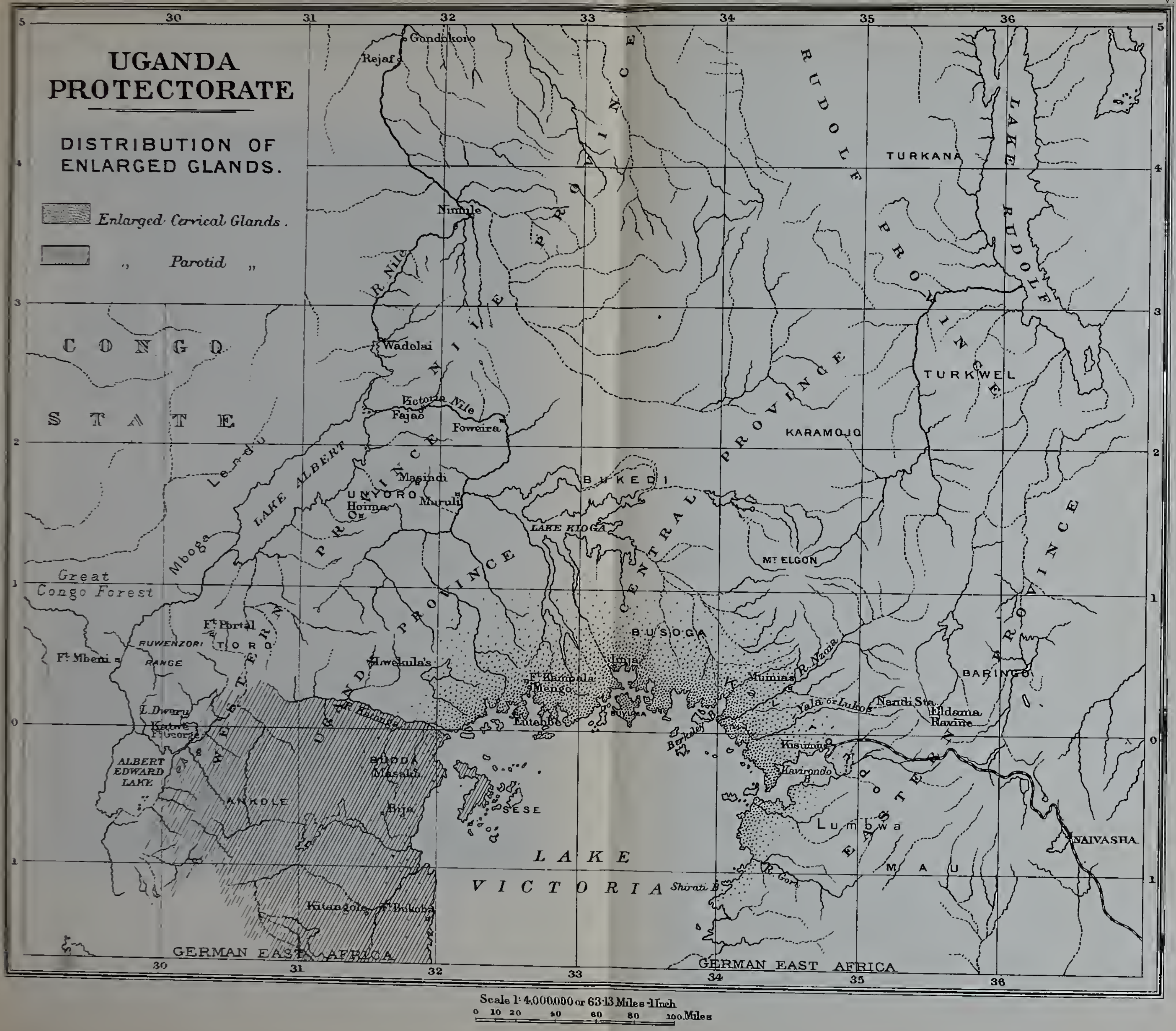
* 'Reise-Berichte über Rinderpest, Bubonenpest in Indien und Ost-Afrika, Tsetse oder Surra-Krankheit, Texasfieber tropische Malaria, Schwarzwasserfieber,' Berlin, 1898.

20. ACKNOWLEDGMENTS.

I cannot close this report without acknowledging with gratitude the help of the various officers of the Protectorate and friends, with whom I was thrown in contact in the course of my researches. Most of all I am indebted to H.M. Commissioner, Lieut.-Colonel J. Hayes Sadler, C.B., Mr. J. F. Cunningham, Chief Secretary to the Administration, Mr. George Wilson, C.B., Deputy Commissioner, Mr. W. Grant, C.M.G., Sub-Commissioner for Busoga, and the various members of the Uganda Medical Staff. I particularly wish to mention my indebtedness to the White Fathers (whose hospitality I enjoyed on many occasions) who, with their close association and knowledge of the natives, procured for me many microscope slides, and much information that I could not otherwise have obtained. I also have to thank Mr. W. G. Doggett for his valuable assistance in procuring photographs of Sleeping Sickness cases.

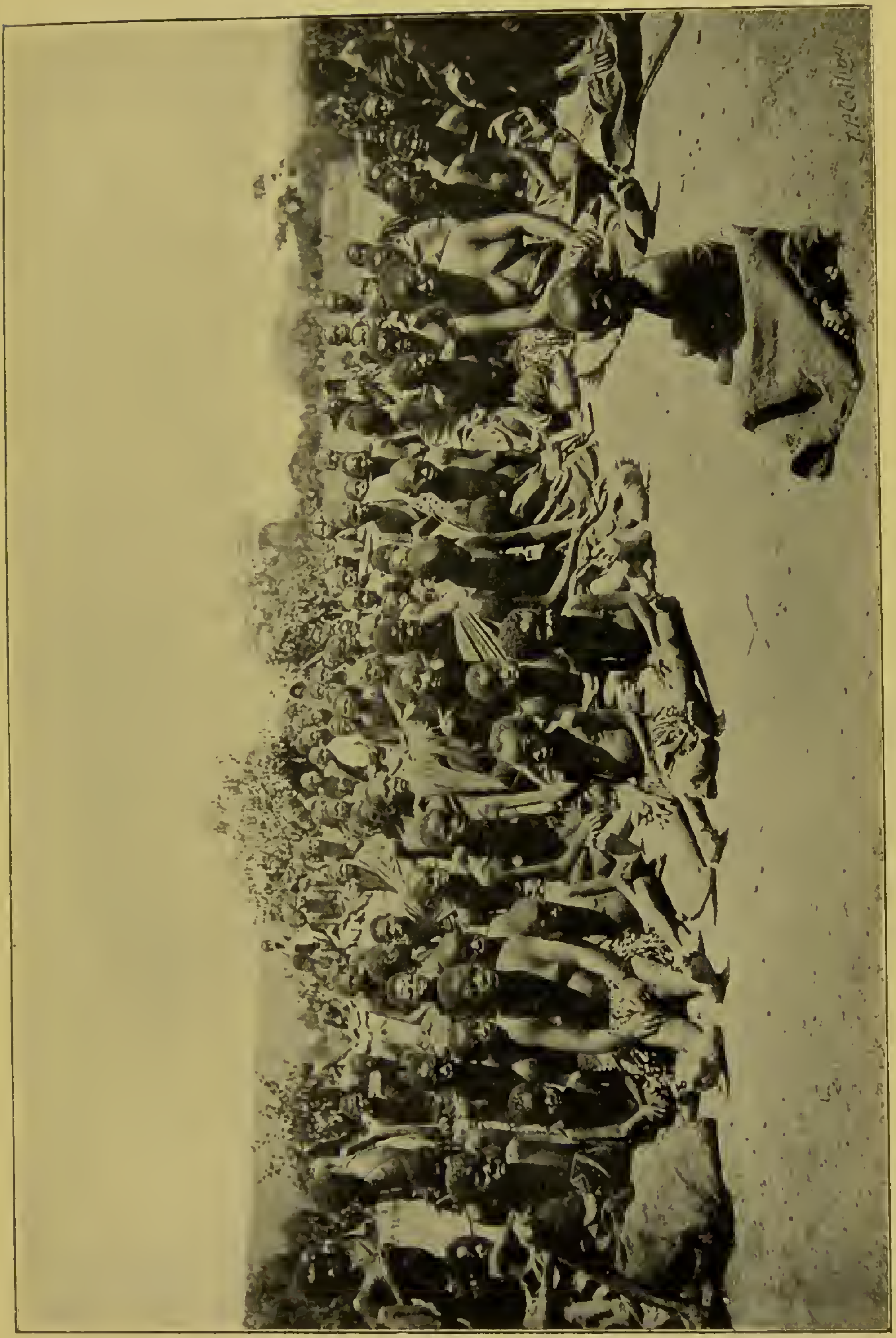
V.



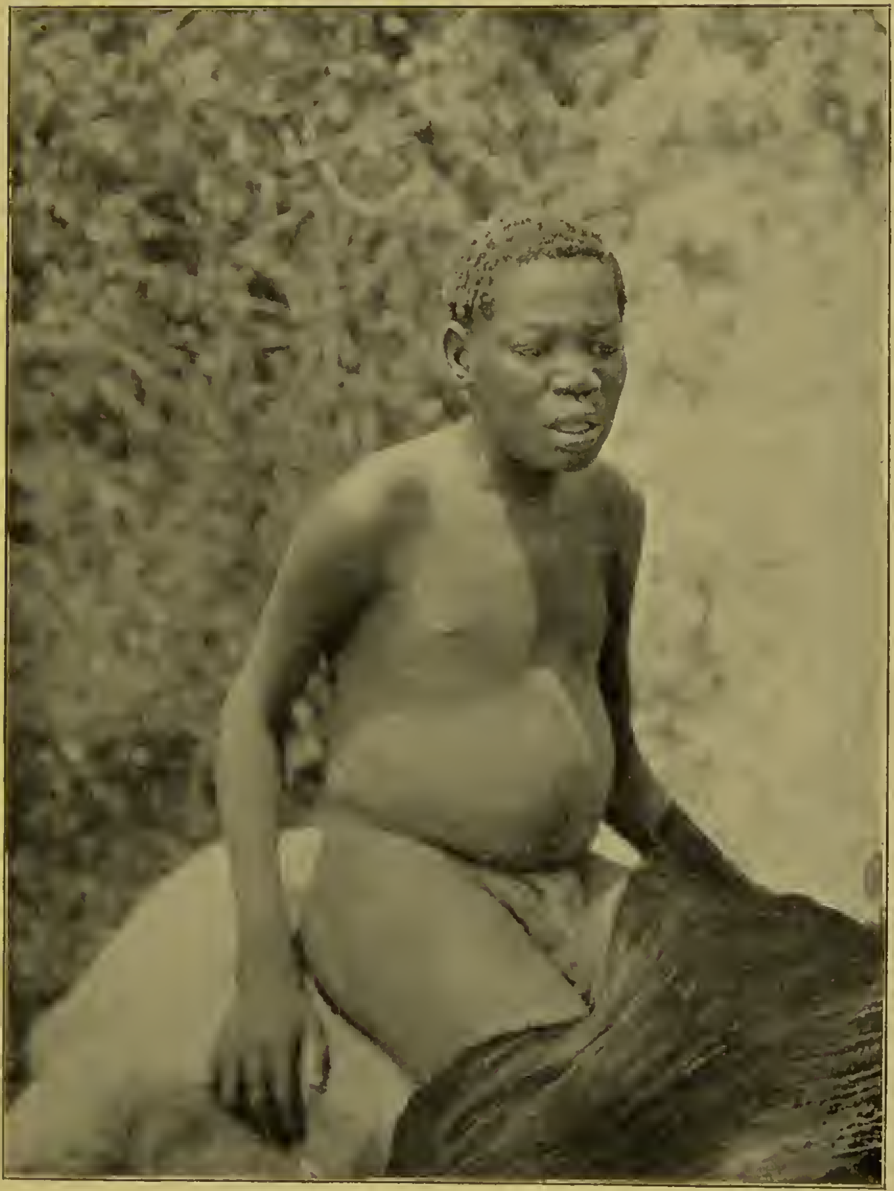
UGANDA PROTECTORATE

DISTRIBUTION OF ENLARGED GLANDS.

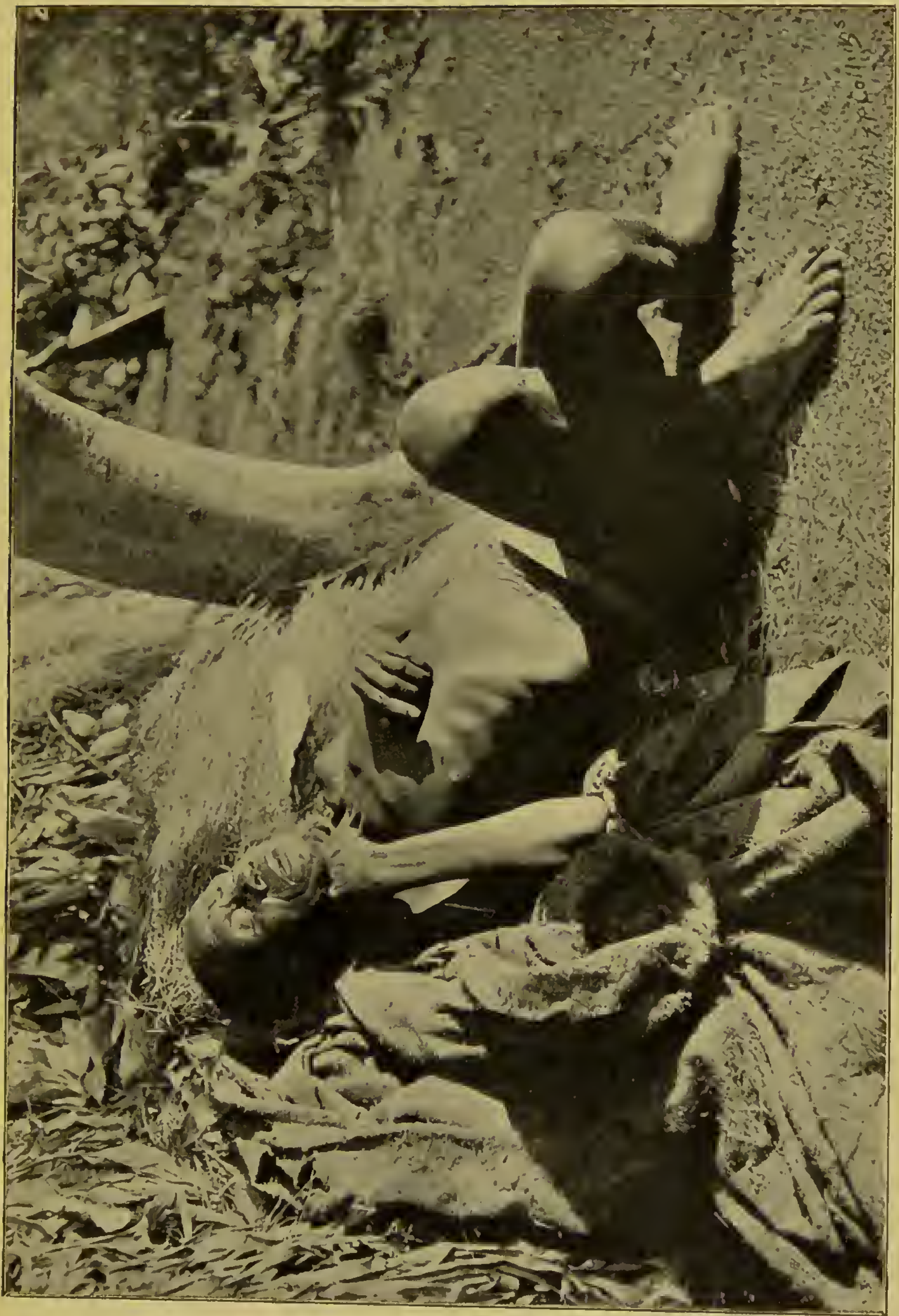
BUVUMA ISLAND. IN THE SHAMBAS.



Buvuma Island. Sleeping Sickness and Starvation.



SLEEPING SICKNESS. THE BLOATED TYPE. THE SECOND STAGE.



SLEEPING SICKNESS. LAST STAGE. LETHARGY.

7.

REPORT ON A COLLECTION OF MOSQUITOES AND OTHER FLIES FROM EQUATORIAL EAST AFRICA AND THE NILE PROVINCES OF UGANDA.

(Made between June, 1902, and April, 1903.)

BY FRED. V. THEOBALD, M.A., ETC.

(With Map)

The large number of Culicidæ and a few other flies collected by Dr. C. Christy during his marches while investigating the recent outbreak of Sleeping Sickness on the Victoria Nyanza are of particular interest in showing the distribution of certain species. The collection contained one new species belonging to the Culicidæ, and shows us the chief annoying forms that occur in the region traversed, the specimens having been mainly taken in tents, etc., at the different camps and not searched for otherwise. It is in these species that we should endeavour to trace out the life-history, for many of them are common in the few towns and native huts all over Central Africa. The *Tæniorhynchus fuscopennatus* seems to be very abundant judging from the bottles full brought back by Dr. Christy from so many localities. Other collectors have also sent it in numbers from Uganda.

The collection for descriptive purposes is valueless; as time was important the specimens were simply put in numbers in glass tubes and in consequence were all more or less damaged, but merely for the purpose of distribution this method of collecting is ample.

The number of species of Culicidæ identifiable was sixteen, comprising the following:—

Pyretophorus costalis. Loew.
Myzomia funesta. Giles.
Myzorhynchus paludis. Theobald.
Myzorhynchus mauritianus. Grandpre.
Cellia pharoensis. Theobald.
Cellia squamosa. Theobald.
Christya implexa. Nov. sp.
Stegomyia sugens. Wiedemann.
Culex luteolateralis. Theobald.
Culex metallicus. Theobald.
Culex viridis. Theobald.
Culex fatigans. Wiedemann.
Culex sp. ? (too damaged to describe).
Tæniorhynchus fuscopennatus. Theobald.
Tæniorhynchus annettii. Theobald.
Mansonia uniformis. Theobald.

Besides the Culicidæ there were species of *Psychodidæ*, a few *Tipulidæ*, a *Ceratopogon*, and a *Simulium*, amongst the Nematocerous flies; amongst the Brachycerous a single Tabanus, *T. dorsovitta* (Walker).

FAMILY CULICIDÆ.

GENUS CHRISTYA. *Nov. Gen.*

Allied to *Myzorhynchus* (Blanchard) but easily told by the long lateral tufts of abdominal scales.

Head clothed with long upright forked scales and some short scales rather broadened in front; palpi densely scaled; thorax with hair-like curved scales and narrow-curved lateral ones; prothoracic lobes with narrow-curved scales; abdomen with hairs and dense lateral tufts of long hair-like scales, the tufts apical and also other long lateral hairs; wings with dense short lanceolate lateral vein-scales; fork-cells rather short. The ♀ only known.

This genus comes in the *Anophelina* and can at once be distinguished by the marked lateral abdominal tufts of long hair-like scales. It was first taken by Dr. Christy, after whom the genus is named.

Christya implexa. N. sp.

Thorax rich umber brown with golden hair-like scales and a few narrow-curved ones laterally, a narrow cinerous line on each side; pleuræ deep brown with three diverging grey lines and some small white scales; head with black and golden upright forked scales and some short golden ones in front between the eyes; palpi densely scaled with brown and white bands. Abdomen black with pale brown hairs and with long dense lateral tufts of black and golden hairs. Legs deep brown, the femora and tibiæ with white spots and to some extent the hind metatarsi; the fore and mid tarsi with the two first joints with basal white bands and to some extent the other two: in the hind legs, the apex of the metatarsi white, the apical two-thirds of the first tarsal and all the rest, except the apex of the leg, black: wings with dense blackish brown scales, the costa with two very large yellow areas, one basal and two small ones nearer the apex, the smallest the second from the apex; veins mostly dark scaled, a few yellow areas.

♀ Head black with long black upright forked scales behind, golden ones in front, and short golden ones between the eyes; palpi densely scaled with black and bands of white scales: some yellow ones at the base (damaged); proboscis black; antennæ banded black and testaceous, the basal joint testaceous, the second with dense black scales. Thorax rich dark chestnut brown with curved hair-like golden scales, small flat pale creamy ones laterally and in front, a pale grey narrow line on each side of the mesonotum due partly to the pale flat scales, partly to the grey sheen on the integument; prothoracic lobes deep testaceous with small flat creamy scales; scutellum deep brown with curved hair-like golden scales; metanotum deep brown; pleuræ deep brown with some flat white scales and with frosty grey lines, three prominent ones radiating from a central point.

Abdomen steely black with short pale brown hairs over the dorsum and with long black and golden lateral hairs, the black in prominent apical tufts; on the venter are several prominent silvery white spots forming a lateral line.

Fore legs deep brown, the femora and tibiæ with white spots, a few only on the femora and one prominent pale band, the tibiæ with six white spots, the metatarsi and first three tarsals with narrow white basal bands; mid legs as in the fore, but the femora with numerous white spots; hind legs with the femoral and tibial spots more numerous; the metatarsus much longer than the tibia, black with a narrow white apical band, the apical two-thirds of the first tarsal white, remainder white except the apical part of the foot.

Wings with dense blunt lanceolate scales, mostly brown, but some forming yellow spots; the costal border with a large yellow apical spot which spreads on to the first long vein, the next costal spot about the same size spreading on to the first long vein, but with a small median dark spot on the latter, the next costal spot minute, not spreading on to the first long vein, apical spot larger and spreading evenly on to the first long vein; veins all dark scaled otherwise, except at the base of the fork-cells and at the posterior cross-vein and a small area at the base of the third vein; fork-cells short, the first submarginal longer and narrower than the second posterior, its base nearer the base of the wing, its stem about as long as the cell, stem of the second posterior longer than the cell; fringe black, a yellow spot at the junction of the upper branch of the fifth and the lower branch of the second posterior cell; (apex ?).

Length: 6 mm.

Time of capture: August (Dr. Christy), June (Dr. Hodges).

Habitat: Togo (Busoga), Pokino (Toro), Mumia's boma (Kavirondo), Bulema (Ankole) (Dr. Christy), and Jinja (Busoga) (Dr. Hodges).

Observations.—Described from a damaged ♀ taken by Dr. Christy in August, 1902, and the description completed from a specimen taken by Dr. Hodges in June, 1903.

It cannot be confused with any other Anopheline on account of its marked abdominal character, the long lateral tufts of hair-like scales.

Pyretophorus costalis. Loew.

(Mono. 'Culicidæ,' vol. 1, p. 157, and vol. 3, p. 74.)

This common African Anopheline was taken at Kamuli, the capital of the Gabula country (Busoga), in a tent on August 22; also at Sambwa, in the Bukedi country, "where mosquitoes are terrible"; also at Bikira (Buddu). The specimens are quite typical.

It has also been sent from Lagos (Nigeria), Entebbe (Uganda), Maniumba (Busoga), Togo, Cameroon, Gambia, Freetown, Bonny, Salisbury, Senegal.

Myzomyia funesta. Giles.

(Mono. 'Culicidæ,' vol. 1, p. 178, and vol. 3, p. 34.)

Typical *funesta* were taken at Kamuli (Busoga), in tent with *costalis* in August; at Ngo, Gabula's country (Busoga), on the border of Lake Kioga, in August. "At Ngo, near the lake, mosquitoes were more troublesome than elsewhere in Busoga"; at Sambwa (Bukedi) with *costalis*; at Ngola Fort (Bukedi), in tent (*vide M. uniformis*); Lusinga Island (Kavirondo); and at Wadelai (Nile Provinces).

This has also been sent from Senegal, Lagos, Gambia, Natal, British Central Africa, Sierra Leone, Mashonaland, Zomba, Lake Chilwa, B.C.A., Tanganika Plateau, on Zambesi and Congo watersheds, and up the Zambesi as far as the Lupata Gorge.

Myzorhynchus paludis. Theobald.

(Mono. 'Culicidæ,' vol. 1, p. 128, and vol. 3, p. 86.)

A single ♀ at Sambwa (Bukedi) with *costalis*, and another from Kisimbika (Uganda). The wings are very dark.

The same species is recorded from Kalmiga, Sierra Leone, Bahr el Ghazal.

Myzorhynchus mauritianus. Grandpre.

(Mono. 'Culicidæ,' vol. 1, p. 129.)

A single ♀ at Bujaju (Buddu), and another between Mbarara and Kichwamba (Ankole).

Also recorded from Natal, Pretoria, Bahr el Ghazal, Wadi Nutrun (L. Egypt), and Mauritius.

Cellia pharoensis. Theobald.

(Mono. 'Culicidæ,' vol. 1, p. 169, and vol. 3, p. 109.)

Specimens collected at Wadelai (Nile Provinces), and at Sircaos on the banks of the Nile, four marches north of Wadelai. Of the latter locality, Dr. Christy says: "The tent roof was black with this species in the morning, but none were to be seen in the evening. I noticed this same peculiarity in the case of *Cellia squamosa*. Both species adopt the 'Anopheline' attitude when at rest."

Also recorded from Gambia, Mashonaland, Rosaires, on the Blue Nile, and Cairo.

Cellia squamosa. Theobald.

(Mono. 'Culicidæ,' vol. 1, p. 167, and vol. 3, p. 109.)

Specimens taken at Kajira, Masawa country (West Elgon); a single ♀ also at Lusinga Island (Kavirondo).

The same species has been recorded from Pretoria, Mashonaland, British Central Africa, Uganda.

Stegomyia sugens. Wiedemann.

(Mono. 'Culicidæ,' vol. 1, p. 300.)

A few ♀'s from Entebbe (Uganda). Most of the Central African specimens are very small.

Same species also from Freetown, Nubia, Mashonaland, Gambia, and Corsica, and recently from India (Christopher).

Culex luteolateralis. Theobald.

(Mono. 'Culicidæ,' vol. 1, p. 71.)

This abundant West Coast and Central African species was taken at the following localities:—Sirwanga (Busoga), in August, "specimens caught in grass at back of tent; swarms of them here, but not in tent." Lusinga Island (Kavirondo); Entebbe, "caught in Commissioner's house, and in my tent." Koko, and other places on the Buddu road, Bujaju, Masaka, Kiabogo, Bikira (Buddu); Mbarara and Kichwamba (Ankole), and at Wadelai (Nile Provinces).

Also recorded from Durban, Salisbury, Straits Settlements (rare).

Culex viridis. Theobald.

(Mono. 'Culicidæ,' vol. 3, p. 212.)

Kampala (Uganda) in August, "bred from larvæ in old chattie containing almost black infusion of leaves and grass; the eggs are laid in rafts." Dr. Christy found five times as many males as females bred out from these larvæ; also taken at Kukungulo's boma near western slopes of Mount Elgon; between Mbarara and Kichwamba (Ankole); and at Mongala, the most southerly station in the Sudan.

Others have recorded it from Buse (Uganda), and Gambia.

Culex metallicus. Theobald.

(Mono. 'Culicidæ,' vol. 2, p. 63.)

Only two localities in which *metallicus* occurred, namely, Nisomba in the Gabula country (Busoga) in August, and at Wadelai on the Nile in February. "Caught in tent, found in evening, scarcely one to be found in the morning."

Also recorded from Bonny, and Senegal.

This Culex seems to be very local, as but few are sent in collections from Africa.

Culex fatigans. Wiedemann.

(Mono. 'Culicidæ,' vol. 2, p. 151, and vol. 3, p. 225.)

Specimens found at Sirwanga (Busoga) in August, and at Sanji (Buddu).

This species is almost cosmopolitan.

Culex, sp. ?

Some damaged specimens from the Yala River (Kavirondo) where mosquitoes were rare, and from Kukungulo's boma near the western slopes of Mount Elgon, also from Lusinga Island (Kavirondo) and Bujaju (Buddu) are apparently a new species, but as they are all rubbed and damaged, they cannot be described.

Tæniorhynchus fuscopennatus. Theobald.

(Mono. 'Culicidæ,' vol. 3, p. 265.)

One of the most abundant of Central African species. From the great number of specimens brought back by Dr. Christy, it is evidently very plentiful in most parts of Uganda. He took it in the following places:—Namaiba (Uganda), on Jinga Road, caught in tent in August; Budaka Fort, Bangwemi district (Mount Elgon), September; Busoro, in Kavirondo, south of Mount Elgon; Mumia's to Kisumu, in Kavirondo; Nakirebe and Koko, on Buddu Road; Sese Island; Bujaju; Masaka; Kiabogo, Bikira and Sanji, in Buddu; Kifumbero, in German East Africa; between Mbarara and Kichwamba, in Ankole; along the Katwe-Toro Road; Kibero, Marengi, Tagweta, Aombo and Keganwa, in Toto; and at Lwekula's, Nabukasi, Kinyenya, Kajongola, Masevi, Bigo, Entebbe, Kalasa, Kisimbiki, Nyenge and Kisingo, in Uganda.

Dr. Christy says: "The habits of this species are in many ways peculiar. In swamp regions it bites at any time during the day, more particularly in dull or wet weather. It is the only mosquito I have met with that can be said to fly to a light. Frequently, in the Bukedi country, beyond Lake Kioga, where clouds of this species can be seen in the day-time, quite a halo of them surrounded any lamp placed in the open, the insects flying against the glass. Their bite is not painful, and produces no subsequent irritation, as far as my personal experience goes."

Tæniorhynchus annettii. Theobald.

(Mono. 'Culicidæ,' vol. 2, p. 205.)

A single ♀ from Marenge (Toro). Also recorded from Old Calabar.

Mansonia uniformis. Theobald.

(Mono. 'Culicidæ,' vol. 2, pp. 187 and 180, and vol. 3, p. 273.)

This common species was taken at the following places:—Nisomba (Busoga) in August; Ngo (Busoga), on the border of Lake Choga, also in August; Sambwa (Bukedi), "caught in tent"; Erosi (Bukedi), "in tent, mosquitoes terrible"; Ngola Fort (Bukedi), "also in tent, mosquitoes terrible"; Budaka Fort, Bugwemi district (Bukedi), in September; Nbowa Fort (Bukedi), 2 hours east of Budaka, in September; Kukungulo's boma, near western slopes of Mount Elgon; Sigula Island, near Port Victoria (Kavirondo); Nyacach and Lusinga Island (Kavirondo); Entebbe (Uganda); Sese Islands; Mbarara to Kichwamba (Ankole); Wimi River (Toro); several camps in Unyoro; and at Wadelai, on the Nile.

It has also been recorded from:—Lagos, Fort Johnson; Zomba; Gambia, at Bathurst; Chiromo; Lower Shire, B.C.A.; Old Calabar; White and Blue Niles, at Kanessa on former, Rosaires on latter; Sudan; Bahr-el-Ghazal; Lagos; Touggourt, Algeria; Natal, at Pinetown Bridge; Ceylon; Dacca; Perak; Travancore, S. India.

FAMILY PSYCHODIDÆ.

Phlebotomus sp.

Several taken at Kampala (Uganda); Dr. Christy says it is very common in Uganda in water-closets. The larvæ were discovered in the same vessel as *C. viridis* were found breeding in. This Owl Midge occurs in most collections brought back from Western and Central Africa, and appears to be generally abundant.

FAMILY CHIRONOMIDÆ.

Ceratopogon sp.

A single small Ceratopogon was taken at Sirwanga's, Tabingwa's, and Kinampere, in Busoga. Dr. Christy says: "It is very common in many places, usually near habitations. This minute fly can pass through the finest mosquito netting; muslin I have not tried. It bites terribly, leaving an irritating wheal, which itches for days. It makes a sharp short peevish buzz when settling, fully as loud as a mosquito. It attacks the wrists chiefly, but is able to pass beneath a sheet, and bite the ankles and feet. Many were frequently found full of blood on turning down the bed-clothes. I have met with a similar fly, with the same habits, at Ahmednuggar (Bombay Presidency), India."

FAMILY SIMULIDÆ.

Simulium damnosum. N. sp.

Dr. Christy remarks:—"In travelling through Busoga westward, one passes abruptly, 3 or 4 miles from Jinja, on the Nile, into a 'belt' of this terrible pest, locally known as the 'Jinja fly.' This belt extends, I believe, from the shores of the Victoria Nyanza about Lubwa's in Busoga, northwards, along the right bank of the Nile, for 12 or 15 miles or more, and is perhaps 3 or 4 miles wide. In this area the flies swarm at certain seasons in millions, and are such a plague that, according to Dr. Hodges, the Medical Officer for Busoga the natives have to leave their shambas (plantations). I do not remember to have seen the fly on the left bank of the Nile, and I cannot recollect to have met with it in any other part of the Protectorate. There is a patch of particularly dense forest within the 'Jinja fly' belt, where the flies are particularly numerous, and in passing through it I was surprised to find the fresh tracks of buffalo, now a rare animal in Uganda. The hide of a buffalo is a particularly thick one, which probably explains the reason why the animal is able to roam through belts of tsetse and other biting flies, for it has frequently been associated with the former. The bite of this small fly is a very severe one, and causes a wheal which itches intolerably, and is marked by a large drop of blood. If many flies are allowed to bite and gorge themselves the part streams with blood from the oozing of the punctures. On nearing the sphere of influence of the 'Jinja fly' each porter stops and breaks off a leafy branch to use as a fly swish, the whole of them then collect into a bunch, and travel at increased speed."

The fly is 3 mm. long, of a general black colour, head, palpi, and antennæ black except at their base, where they are bright testaceous; thorax black, the meso-thorax with bright deep golden, thick, short, curved hairs closely applied to the surface of the thorax. Meta-thorax, black, abdomen black, shiny with short black hairs, fore and mid legs black; the metatarsi of the hind legs with a broad median pale yellow band; wings bright, testaceous at the base; halteres ochraceous; the metatarsus and especially the first two tarsi much swollen in the fore legs, the two last tarsi small, very hairy, less so on the mid and hind legs; ungues all dentate.

FAMILY TABANIDÆ.

A single species of Tabanus, the *Tabanus dorsovitta* of Walker, was taken at Bikira (Buddu). This "gad-fly," known as the "Serut Fly," occurs, not only on the West Coast, but in Central Africa and down nearly to the Sudan, for specimens have been sent me by Veterinary Colonel Griffiths, D.S.O., from Fashoda, where it is very annoying to camels and mules as well as man.

Since the identification of the insects in the collection, Dr. Christy has made a study of the distribution of each species with regard to its possible connection with either Sleeping Sickness or *Filaria perstans*, and he sends me the following notes:—

"There seems to be no species of mosquito whose distribution in any way corresponds with that of Sleeping Sickness. At no place within the infective area of that disease on the Victoria Nyanza were mosquitoes of any species a pest at the time of my visits, from July to October. Most of the country bordering the north shores of the lake is not suitable for them, being high ground, and areas of swamp are few.

"With regard to *Filaria perstans* I find that only in the case of one species does the area of distribution seem to partly correspond with that of the blood worm. This species is *Tæniorhynchus fuscopennatus*.

"Beyond the Nzoia River (Kavirondo), which is the extreme easterly limit of *F. perstans*, I only obtained this species at one locality, namely near Kisumu. With this exception the agreement of the two areas is merely a geographical one (*vide* Map).

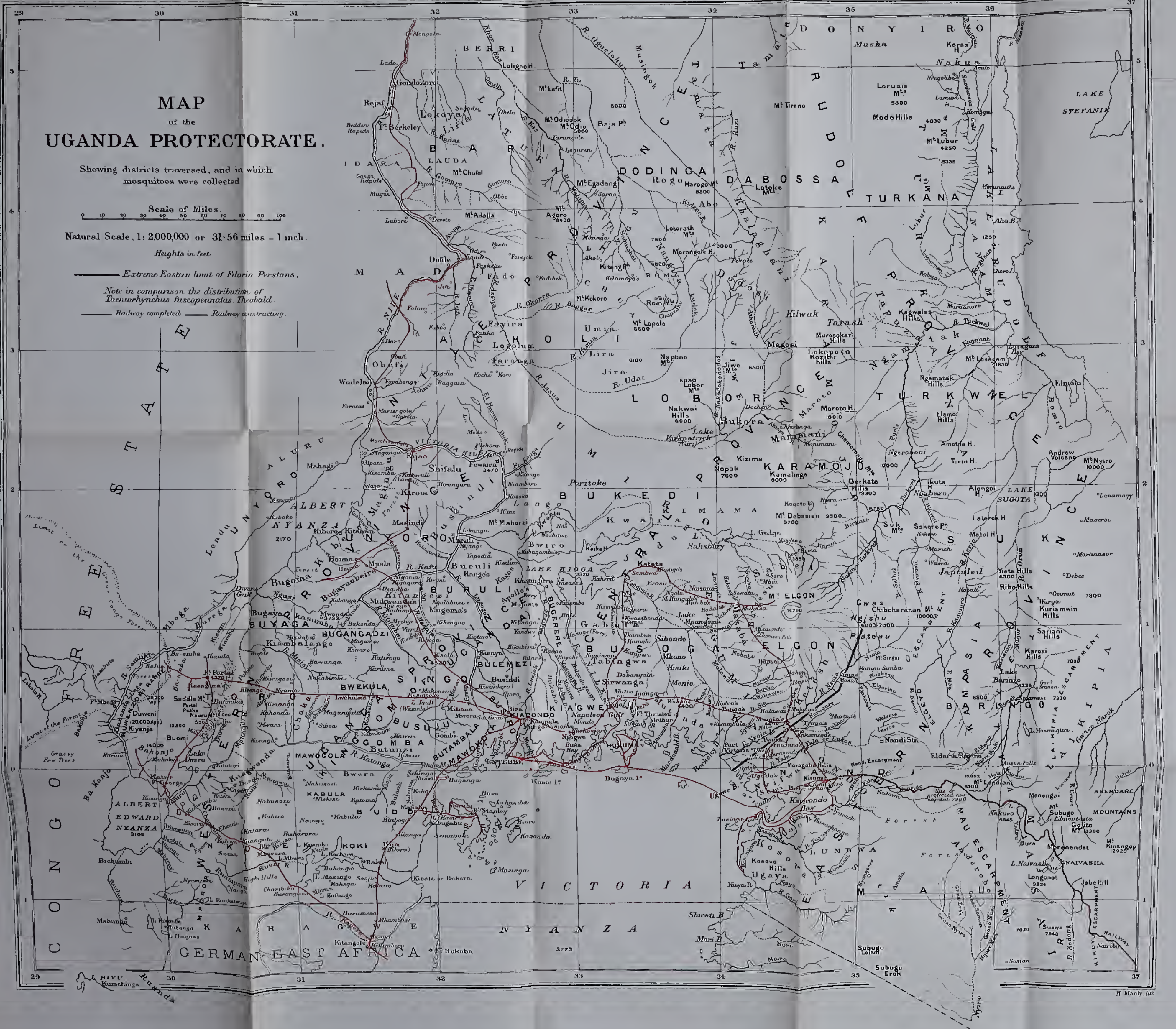
"*T. fuscopennatus* was extremely common in the province of Uganda, west of Kampala, where a high percentage of *F. perstans* existed in the blood of the general population; but on the other hand, although the species was collected in the Sese Islands, mosquitoes there were not troublesome, and the White Fathers told me that at no time in the year were they numerous; yet one of the highest recorded percentages of *F. perstans* was met with in that group of islands. In the province of Busoga also, where a high percentage of *F. perstans* was found, *T. fuscopennatus* was rare. Again, at three spots in the Protectorate the majority of the inhabitants harboured enormous numbers of a variety of *F. perstans* in their blood, yet at these places *T. fuscopennatus* was not more abundant than elsewhere, and at one of the places, namely on the slopes of Mount Elgon, I found no mosquitoes at all.

"With regard to the Tabanidæ, I met with at least two species. The genus is common in many parts of the Protectorate far away from the Sleeping Sickness area. One species (*T. dorsovitta*) was particularly abundant in the Nile Provinces. Another species belonging, I believe, to this genus, and peculiar, as far as my observations went, to Lake

Kioga, was conspicuous by its very large size, and was, I think, instrumental in the death of a mule I had with me. Unfortunately a tube containing a number of these flies, and a few Tsetse, has been lost."

Dr. Christy also sends me the following table showing the localities, grouped under Provinces, in which were collected specimens belonging to the *Anophelinæ.* The localities, he says, correspond with the different foci of malaria in regions traversed by him, and in fact include all the malarious parts of the Uganda Protectorate. The table is interesting as tending to point to the species mainly implicated in the transmission of the disease.

Province.	Locality.	Species.	Malaria.
Kavirondo	Mumia's	*Chry. implexa*	Simple tertian.
	Majira (Wapoto)	*Cellia squamosa*	?
	Lusinga Island	*M. funesta*	Simple tertian.
Busoga	Siriwanga	? (too damaged)	,,
	Naniumia	*P. costalis*	,,
	Labingwa's	? (too damaged)	,,
	Gabula's (several camps)	*P. costalis*	
		M. funesta	
		Chry. implexa	
Bukedi	Sambwa (Lake Kioga)	*P. costalis*	,,
		M. funesta	
		M. paludis	
	Ngola	*M. funesta*	,,
Toro	Pokino forest	*Chry. implexa*	,,
Uganda	Kisimbika	*M. paludis*	,,
	Entebbe	*P. costalis*	,,
Buddu	Bikiri (mission station)	*P. costalis*	,,
	Bujaju	*M. mauritianus*	?
Ankole	Mlema (Kagera river)	*Chry. implexa*	?
Nile provinces	Wadelai and Sircows	*Cellia pharoensis*	Simple tertian and sub-tertian.
	Blue Nile	*Cellia pharoensis*	,,
	Bahr el Ghazal	*M. paludis*	,,
		M. mauritianus	,,



MAP
of the
UGANDA PROTECTORATE.

Showing districts traversed, and in which
mosquitoes were collected

Scale of Miles.

Natural Scale, 1: 2,000,000 or 31·56 miles = 1 inch.

Heights in feet.

——— *Extreme Eastern limit of Filaria Perstans.*

Note in comparison the distribution of
Taeniorhynchus fuscopennatus. Theobald.

——— *Railway completed* ——— *Railway constructing.*

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